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POWER

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, *President*
MASON BRITTON, *Vice-President*

Editor
FRED R. LOW
General Manager
IRVING FELLNER

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FRED R. LOW'S FORTIETH ANNIVERSARY AS EDITOR OF POWER

WHAT MR. MCGRAW THINKS OF HIM AS EDITOR AND MAN

FORTY YEARS AGO—in 1888—Fred Low found *Power,* then a lusty infant, and *Power* found Fred Low. Never were man and opportunity more happily mated. Today, after four decades of constructive service to industry, Low, the man, stands as a personal embodiment of *Power,* the publication. Surely this milestone in such a career invites more than passing notice. I deem it a privilege to speak intimately with *Power's* readers about Fred Low, as I have known him these many years.

A great paper without a great editor is unthinkable. Publications are countless, but the few real editors of the past and present stand out like peaks above the plain. That is why the most precious assets of any publishing house are its great editors—men who know their fields, can visualize the trends and conditions in these fields, and weigh their problems fully, whose pens and personal contacts make them acknowledged leaders of thought and action. Fred Low has always met this specification and meets it today. His name will rank with such great engineering editors as Wellington, Prout, Weaver, Kirchoff and Wight. They have passed on, but happily Low is still with us, as active as ever in mind and body and continuing to exert a potent influence in the field of power development.

As an educational force among power engineers, Low's earlier writings were unequaled. In later years the philosophies of his signed editorials have attracted wide attention. With sympathetic understanding of others' problems, he is equally at home in talking with the small-plant operator and the large-utility executive. His standing among his fellow engineers received signal recognition a few years ago when he was made president of the American Society of Mechanical Engineers.

These forty years Fred Low has stood with prophetic vision in his eyes, but with his feet squarely planted on reality. He is a man who thinks before he speaks or writes; the pause but adds to the luster of his words. Low is kind and full of human understanding, but without sentimental softness. His is the self-respecting humility of the truly great. Courage is in his eyes and in his heart, but no touch of bravado, nor any need of it. These qualities explain, in part, the universal affection Low commands in those who know him, but there is something more, indefinable and elusive—call it character, personality or what you will—that seals the tie.

As publisher of *Power,* I greet you, Fred Low, through the columns of your paper. May the future add fruitful years to your four decades of inspired service.

James H. McGraw

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FRED R. LOW

A BRIEF HISTORICAL SKETCH

FRED R. LOW, who this year passes his fortieth milestone as editor of *Power*, was born in Chelsea, Mass., April 3, 1860. He attended public school until he was fourteen and then took a place in a Western Union telegraph office, where he learned both telegraphy and stenography. His knowledge of shorthand led to several years' employment as a court and commercial stenographer.

In 1880 he joined the staff of the Boston *Journal of Commerce*, a textile paper with a mechanical department. There he began to study engineering, laying the foundations for his subsequent career. Before long he became editor of the steam-engineering section of the paper.

Throughout the eight years of his connection with the *Journal of Commerce*, Fred Low was actively engaged in mastering the fundamentals of power generation. Nor were these studies confined to the printed page. As a member of the National Association of Stationary Engineers and the proud owner of an indicator, he was in constant touch with the operating engineers of near-by manufacturing plants. He met them at their meetings and worked with them in their engine rooms, setting valves with the aid of his indicator and struggling over their problems of everyday engineering.

During this period, with his friend and partner, Frank M. Clark, he operated the Clark & Low Machine Company and was co-inventor with Clark of a flue cleaner for vertical boilers, an integrating steam-engine indicator, an elevator control and other mechanical devices.

Fred Low came with *Power* in 1888 and has been Editor ever since. Two years earlier he had joined the American Society of Mechanical Engineers. From the first he played an active part in the affairs of the society. He was vice-president from 1918 to 1920 and president for the year 1924. He has been a member of the Boiler Code Committee since 1917 and its chairman since 1925. He served as chairman of the executive committee of the Fuels Division in 1922-23 and has been chairman of the Power Test Codes Committee since its organization in 1918. He has represented the society on the American Engineering Council and at the World Power Conference held in London during the summer of 1924. He is vice-president of the United States National Committee of the International Electrotechnical Commission.

He is the author of four books: "The Power Catechism," "Condensers," "The Compound Engine" and "The Steam Engine Indicator." He is a member of the Engineers Clubs of Boston and New York, the National Association of Power Engineers and the Verein Deutscher Ingenieure.

The honorary degree of Doctor of Engineering was conferred upon Fred Low by the Rensselaer Polytechnic Institute at its centennial celebration in October, 1923. He holds honorary membership in the Institution of Mechanical Engineers (Great Britain), The Marine Engineers Beneficial Association and The National Association of Practical Refrigerating Engineers.

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EDITOR OF POWER SINCE 1888

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An Ope

...ED R. Low

YOUR fortiet... ...niversary as editor of *Power* is welcomed by your staff as an opportunity to express publicly the respect and affection we constantly feel and avow in our private relations.

We have not asked your permission to insert the tributes that appear in this issue; nor have we informed you of our intention. Knowing your insistent modesty in such matters, we feared a veto of our plans. So we have simply seized those powers that seemed justified by the occasion.

You opened this issue expecting to see your Foreword. In its usual position you found a tribute from our chief, James H. McGraw. This and the following testimonials from leading men in the field will undoubtedly mean much to you. But it is our fond hope that these sincere words of appreciation from your own staff may be especially cherished.

No evaluation of a man is more searching than that of his own subordinates. This test you pass with flying colors. Your vision and grasp of the editorial job are a constant inspiration and challenge. Your knowledge of the industry and intimate touch with its leaders and rank and file mark the true editor, as does your ability to express yourself in words that go straight to the mark. You inspire us as an editor, as a leader, and most of all as a man. Your stalwart humanity commends our deep regard.

And so, Mr. Low, there is nothing perfunctory in this affectionate greeting from your staff on the fortieth anniversary of your connection with *Power*. It comes straight from the heart. THE POWER STAFF.

Mr. Low as His Friends See Him

ALEX DOW:

MR. LOW has in his editorship of *Power* been a very present help, in all respects up to the minute, to those of us who have needed confirmation in well doing. His standing among engineers at large is such that any pronouncement by him carried double weight, the weighting it deserved as proceeding from the editor of an important journal, and that which it further deserved as the expression of an engineer of acknowledged competence. My congratulations are tendered with the best of good will.

ALEX DOW, *President,*
The Detroit Edison Company.

DEXTER S. KIMBALL:

NOT many years ago American engineers were dependent upon foreign publications for information concerning the progress of their art and an engineer who could not read French or German was considered to be somewhat handicapped. Today, this handicap no longer exists and no man has done more in bringing about these changed conditions than Dr. Fred Low. His personal contribution and his exceptionally skillful editorial work have made a place for him in the literature of his field that is both honorable and unique.

Nor has his influence been felt alone in this field. In the work of engineering and scientific societies, as a member of many national and international committees and commissions and as a staunch supporter of all movements looking to the upbuilding and dignifying of the engineering profession his earnest efforts and wise counsel have made him a national figure.

Those of us who have had the honor and pleasure of being well acquainted with him have long since learned to adore the man more than his works. When I think of Doctor Low it is his kindly helpful presence and his pleasant smile that comes first to may mind. May he long be with us as a guide and ornament to the profession.

DEXTER S. KIMBALL, *Dean,*
College of Engineering, Cornell University.

ELMER A. SPERRY:

IT IS hard to appreciate the enormous advance that has been made during the able leadership of Mr. Low in the broad field of power. It was only a few years ago, in fact, since the "Mauretania" was built, when ship power-plant units far transcended anything on land, but before long this was reversed and the power units on land have gone forward by leaps and bounds until units exceeding 200,000 kw. are under construction as we write. Not only has Mr. Low been the historian during the period of this enormous activity, but he has been the advance guard holding aloft its emblem, a never failing source of inspiration. He has not only always counseled greater and greater achievement in the field of engineering and production, but has become the unerring and dependable interpreter to the ownership and commercial interests of the true significance and economics of extending the uses of power to larger units and to new fields.

ELMER A. SPERRY, *Chairman of Board,*
The Sperry Gyroscope Company, Brooklyn, N. Y.

CHARLES T. MAIN:

IT IS more than forty years since I first had the pleasure of the acquaintance of Fred R. Low. This acquaintance began in the period when we talked about boilers and engines and waterwheels, all of which were comparatively simple as we look back. Since that time there have been developed the complicated steam-electric and hydro-electric power plants. This development has been greatly stimulated by the helpful assistance of Mr. Low through his connections with the technical press, technical societies and other agencies, and by *Power*, which has been expanded and developed to keep abreast or ahead of the advance of the industry. It gives me pleasure and satisfaction to express my appreciation of this splendid work of Mr. Low and *Power*.

CHARLES T. MAIN,
Consulting Engineer, Boston.

CALVIN W. RICE:

MR. LOW has been editor of *Power* during that period when, through the development of the application of power, all have been emancipated from drudgery.

Mr. Low's special contribution to the success of the publication is the philosophy with which he has clothed the presentation of the technical material and his personally signed articles, which have been unique in such literature.

He has at the same time exemplified the usefulness of the engineer to the community and has served his home town as its chief magistrate. In his participation in the work of the engineering society of his profession, the American Society of Mechanical Engineers, again he is pre-eminent in the length of time in which he has been continuously active—on standing committees, member of Council, president and now chairman of two most important special committees, Boiler Code and Power Test Codes.

CALVIN W. RICE, *Secretary,*
American Society of Mechanical Engineers.

H. D. SAVAGE:

MY DEAR MR. LOW: I understand that October will mark the fortieth anniversary of your editorship of *Power*. What a wonderful panorama of progress you must be able to visualize when you review these four decades, and what a wonderful personal satisfaction you must feel from a realization of the part you have played in this.

Standing as you have, for these four decades, at the wheel of a machine able to direct trends and formulate opinions, your ever-ready willingness not only to meet the changing trends with able thought, but to direct and mold definite opinion along sound lines, has always been of great benefit to industry at large, and the high type of your editorial leadership has done much to raise the standards of all technical journalism.

H. D. SAVAGE, *President,*
Combustion Engineering Corporation.

S. F. JETER:

TWENTY-FOUR years ago last June I made the acquaintance of Fred Low. I had up to that time contributed a few articles to the "Letters" section of *Power*, then a monthly publication.

My first visit to the Editor was primarily for the purpose of airing a grievance, possibly the excessive blue-penciling or entire rejection of some article. However, upon being ushered into the Editor's sanctum, my grievance evaporated in the presence of the genial gentleman I met, and there was begun a friendship that became increasingly close as the years rolled by. I consider Fred Low, by his wise council and kindly aid in many ways, to be largely responsible for whatever success I have had.

While extremely tolerant of the views of others, he detests the charlatan. No doubt his fearless exposures of many frauds in the engineering field have been a godsend to gullible investors.

It is my sincere wish that he may continue for many years to inspire both young and old engineers.

S. F. JETER, *Vice-President,*
The Hartford Steam Boiler Inspection & Insurance Company.

A. G. PRATT:

IT IS with great pleasure I express my associates' and my own sincere congratulations to Fred Low upon this, the fortieth anniversary of his very successful editorship of *Power*. A great opportunity for public service came to Mr. Low; he has taken full advantage of it to the material gain of the industries and those in the industries who have come in contact with him and his work. Few men, indeed, can look back upon a life work so fruitful; few men can count so many friends and well wishers as can Fred Low.

May he edit *Power* as long as he wishes, and be spared to his host of friends many, many years.

A. G. PRATT, *President,*
The Babcock & Wilcox Company.

W. L. ABBOTT:

DEAR MR. LOW: Although in forty years you have found but one job, you are to be congratulated on having been able to hold it.

Your host of readers anticipate each issue of the periodical whose destinies you direct as a new issue of the gospel, and read with delight and admiration the quaint and timely wisdom which flows from your ever-dripping pen.

The thousands who sense your lovable personality, and have learned to profit by the information you disseminate, rejoice in honoring you on this occasion.

W. L. ABBOTT, *Chief Operating Engineer,*
Commonwealth Edison Company.

L. P. BRECKENRIDGE:

MY DEAR FRED LOW: A few years ago I retired from my forty years of teaching mechanical engineering, and I still remember the many nice things you said about my work.

Now it is my chance to congratulate you upon the splendid work you have directed and done in your forty years as Editor of *Power*. I do this with keen delight. I subscribed for *Power* when the first number was issued and have read it ever since. My work as a teacher reached a few thousand. Your work as Editor reached a few millions. You have been a part of the progress in power development, not only as Editor of *Power*, but as a worker with others locally, nationally and internationally. You have been exactly what your paper typified, a power in *Power*.

But after all, I liked you best across our lunch table at the Engineers Club. There I learned much from you. The questions you asked were often hard and made me think. The answers you gave were always clear, concise and full of food for reflection.

Forty years of work and always helping others. Congratulations, many congratulations, from your friend,

L. P. BRECKENRIDGE, *Professor Emeritus, M. E.,*
Yale University.

I. E. MOULTROP:

MY DEAR FRED: Many congratulations to you on the fortieth anniversary of your editorship of *Power*. Under your guidance the paper has become one of our leading technical papers. In my mind one of the

most interesting features is your little sermon which appears on the front page weekly.

With best wishes for your future and also the hope that you may carry on for many years to come, I am,

I. E. MOULTROP, *Chief Engineer, Constr. Bureau, The Edison Electric Illuminating Company of Boston.*

C. HAROLD BERRY:

I AM proud of the opportunity to render tribute to Mr. Low on the completion of forty years as Editor of *Power*. He took the editorial chair when it was obscure and little known, and developed it into a position of leadership that has made him known throughout the engineering world. Untold thousands of men he has helped to climb from the level of the relatively uninformed operator to the plane of the broadly capable engineer, and he has ever been the champion of right, right in the scientific and engineering sense and right in the highest ethical sense.

For the privilege of brief association with him in the editing of the magazine that he made great I shall always be thankful. He is one of the kings among men.

C. HAROLD BERRY, *Professor of Mechanical Engineering, Harvard Engineering School.*

S. W. MILLER:

I HAVE read *Power* for many years, and it is the one of the many magazines which I read that appeals to me most strongly from the human point of view. It is true that it is an engineering paper and a good one, but I know of no other that considers the human element of engineering as it does.

I have been particularly impressed with the sound common sense and understanding that Mr. Low has exhibited in his signed articles, because they take account of what, in my judgment, is the most important thing in this world; that is, our duties to ourselves and to others.

In saying what I have, I do not overlook Mr. Low's ability, his tact, his courtesy, his straightforwardness and all the other notable characteristics that are his. They are obvious to those who have come in contact with him, but I cannot help emphasizing his humanness.

I hope that he will be with us for many years to give us the benefit of his experience and wisdom.

S. W. MILLER, *Consulting Engineer, Union Carbide and Carbon Research Laboratories, Inc.*

JOHN HUNTER:

FOR the last twenty-five years it has been my privilege to know Fred Low, first through his valuable contributions to the profession, through the medium of *Power*, and in later years through a closer and more intimate friendship. In the developments that have taken place in mechanical engineering during this period, Mr. Low has done much not only to assist in guiding the course of these developments, but through his untiring efforts he has been of great assistance to the designing engineers and to the operating men as well.

Mr. Low has been honored in many ways for his contributions and educational help to the profession, but the most outstanding of all is the respect in which he is held by young and old in the engineering profession, and when we extend congratulations and appreciation of the long service rendered we hope he may long be spared to enjoy the fruits of a work well done.

JOHN HUNTER, *Consulting Engineer, St. Louis, Missouri.*

THOMAS E. MURRAY:

IT HAS been my privilege to know Fred R. Low almost the entire period of his editorship of *Power*. I have followed his work with great interest, and the power industry has been greatly indebted to him for his efforts to advance the art of power-plant engineering.

Power, under his leadership, has been the outstanding publication in its line, and his work has been an inspiration to thousands of operating men throughout the land.

May the Good Lord spare him many years to his family and friends.

THOMAS E. MURRAY, *Vice-Chairman of the Board, New York Edison Company.*

FRANCIS HODGKINSON:

I HAVE learned that October, 1928, will mark the fortieth year of the editorship of *Power*, of my friend, Dr. Fred Low. The McGraw-Hill Company is to be congratulated upon having been served by one so able and so universally beloved.

My association with Doctor Low has been more or less continuous throughout the whole of the steam-turbine development in this country, and I cannot but bear testimony to his unvarying kind nature and fairness in his editorial work.

I wish Doctor Low many more years of usefulness.

FRANCIS HODGKINSON, *Consulting Mechanical Engineer, Westinghouse Electric & Manufacturing Company.*

ELMER L. BASSETT:

MY DEAR MR. LOW: While in attendance at the recent forty-sixth annual convention of the N.A.P.E. at Detroit, Michigan, I learned that this October marked your fortieth anniversary as Editor of *Power*. It is with deep respect and high regard that I offer my heartiest congratulations on this occasion.

The science of engineering has profited in no small measure by your untiring efforts, and your contribution to the remarkable advancement and development in this field and profession is appreciated by the engineers at large. Your forewords and editorials in *Power* are always of great interest and value.

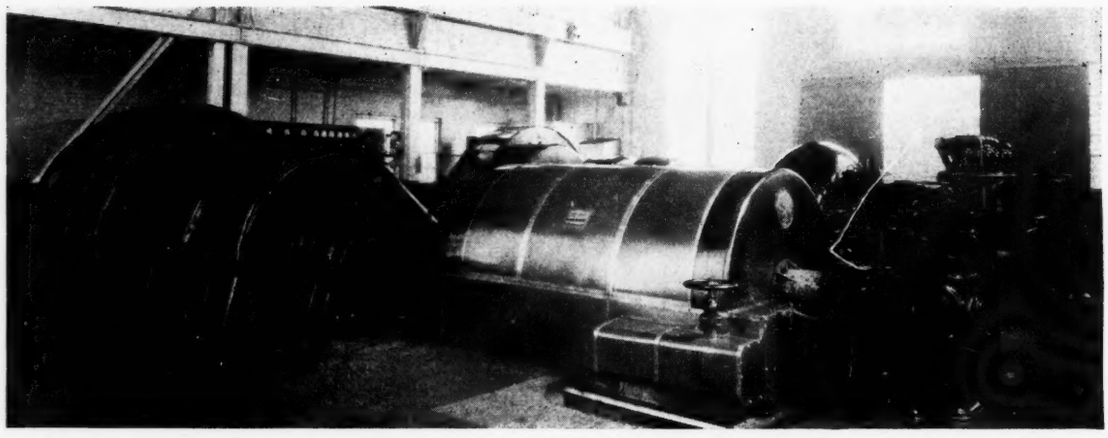
With sincere wishes for your continued success,

ELMER L. BASSETT, *Past National President, National Association of Power Engineers.*

CHARLES A. MCALLISTER:

I HAVE had the honor of Mr. Low's friendship for many years and am glad to have this opportunity to testify to his remarkable abilities and personality. He speaks the language of engineers of all degrees of attainment. He is a welcome guest in any gathering, high or low, where engineers assemble. From a marine standpoint I have seen him mingle and be a hail fellow well met with those hearty men who drive American ships at sea in all climates, and I have also seen him in company with the greatest technical engineers in the world, serving as President of one of America's greatest engineering societies. A man of such rare abilities must be an outstanding character. Long may he live to enjoy the association of those for whose interests he has continually striven.

CHARLES A. MCALLISTER, *President, American Bureau of Shipping.*



Extraction turbine, which takes steam at 410 lb., exhausts at 20 lb., and extracts at 150 lb., supplying steam for paper-making processes

HIGH STEAM PRESSURE

Characterizes Modernized Industrial Power Plant

IN 1926 the West Virginia Pulp & Paper Company decided to install additional boilers at its Covington, Va., plant to take care of increased production and to replace other boilers that were nearing the end of their useful life.

At that time steam was generated in two boiler houses, one containing eleven boilers with a total heating surface of about 65,000 sq.ft., while the other had six boilers of 32,000 sq.ft. total. These were all of horizontal water-tube design with economizers and superheaters. The stokers were of underfeed design, burning New River coal. These boilers were operating at 175 to 200 per cent of rating most of the time, and in winter there was little reserve capacity.

Electric current, three-phase, 25-cycle, was generated by six units, five operating at 440 volts and one operating at 6,600 volts to serve remote parts of the plant. Three of the units were rated at 1,500 kw., two at 3,000 kw., and one at 4,500 kw. One of the 1,500-kw. units operated straight condensing. The others were arranged to bleed steam at 20 lb. pressure for use in the mill. The average load was 12,000 kw. There were also several reciprocating engines, driving paper machines and bleach and screen room equipment, that exhausted into the 20-lb. main.

A study developed several methods of meeting the new conditions, which would impose an increased load of 2,500 kw., and at the same time increasing the reserves. These follow:

1. Install additional boiler or boilers in the present boiler houses and push the existing equipment further by means of new stokers, powdered-coal burning or other expedients.

2. Buy outside power and use part of the existing equipment for direct steam at lowered pressures, if necessary.

3. Lay out a completely new plant at a new site, to be constructed in units from time to time as required for plant growth and as the older equipment becomes obsolete.

The studies and estimates showed a number of things: Increasing quantities of 150-lb. and 20-lb. steam would be needed for process work in the future. The larger existing turbines were good for many years of work at good efficiencies within their temperature range. The condenser equipment was sufficient for 12,000 kw. capacity. It would furnish more warm process water than was needed. There was also sufficient capacity to take care of irregularities in power made from process steam. While boiler efficiencies were good, from 10 to 20 per cent better efficiency could be expected from more modern equipment. One-half of the existing boilers, with their furnace equipment, could be counted on for ten years, though not capable of adaptation to higher ratings without undue expense.

Outside power could not compete with power derived from high-pressure steam discharged at process pressures. Existing boiler houses were not large enough to house the additional capacity required. The generation of steam at 425 lb. pressure would require no non-commercial equipment and if the required additional capacity in kilowatts could be manufactured by expanding 425-lb. steam to 150- and 20-lb. pressures, a good heat balance would result, giving additional requirements of 150-lb. steam at a cost of five to ten cents per thousand less than the existing cost. In doing this no additional condenser capacity would be required. It was found further that

units to make and utilize about 140,000 lb. of steam per hour could be operated base load with a maximum efficiency and a minimum of control troubles.

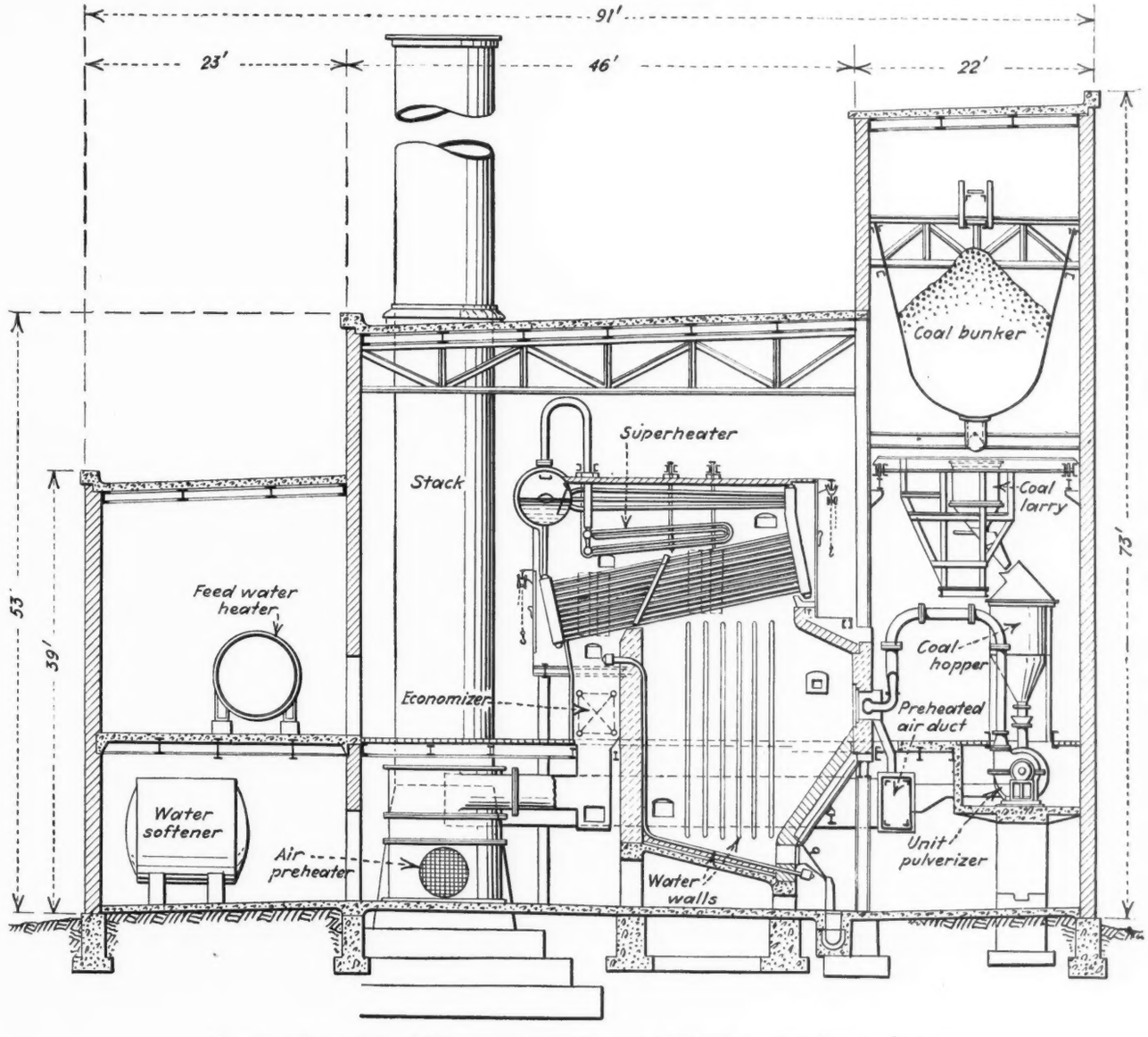
In accordance with the third proposal a boiler house was laid out for five units, each of two boilers, ultimate equipment. Each boiler had a normal capacity of 70,000 lb. steam per hour at 425 lb. pressure and 190 deg. F. superheat. The maximum unit capacity was 90,000 lb. of steam per hour. These boilers had inclined tubes and cross-drums. The furnaces, having partly water-cooled walls, were designed for powdered coal firing. Operation was to be normally at 250 per cent of rating, with a maximum of 325 per cent.

The boiler house was designed to be wholly above ground. Boilers were placed in separate settings. The furnace depth was about 23 ft. Side walls, back and bottom were water-cooled. Superheaters of the convection type were selected and located between the first and second pass, the boiler being baffled to give two cross-tube passes.

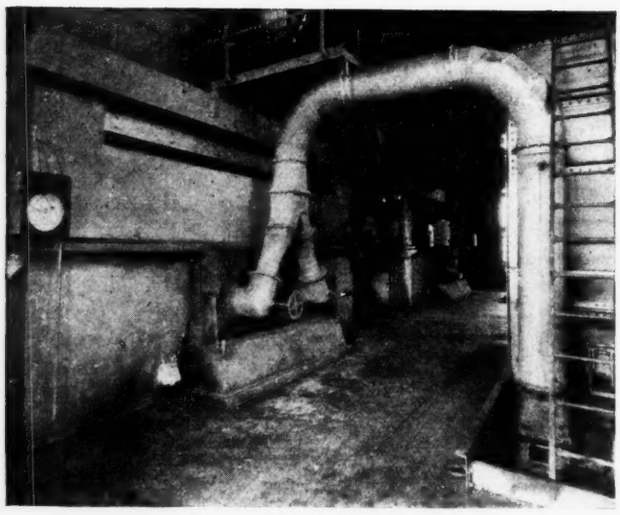
To recover part of the heat from the gases which leave at from 750 to 800 deg. F., a regenerative air preheater was installed with a small economizer between it and the boiler, so that gases reaching the preheater would not exceed a temperature of 650 deg. F. The preheaters were built with integral induced- and forced-draft fans, driven by turbines taking steam from the 150-lb. main. Between the economizer and preheater a baffle-type dust collector was installed. The gases are discharged from the preheater into a self-supporting steel stack, 9 ft. in diameter and 150 ft. high.

Fuel is prepared by unit impact pulverizers, taking coal from an overhead bunker through a distributing weigh-larry and small coal hopper. Coal is brought to the plant and dropped through a trestle to a crusher, thence elevated by a drag chain and sent to a distributing conveyor over the bunkers. All this equipment is motor-driven. No outside coal storage was provided because of the near-by reserve supply of the old plant and the short haul from the mines in a climate not likely to be disturbed by winter storms.

Burners of the turbulent type were adopted. No ash-handling equipment was provided, as the coal runs less than 5 per cent ash, 80 per cent of which can be



Cross-section of the high-pressure boilers at Covington, showing coal storage and preparation equipment



Front of the boilers, showing powdered coal burners and feed pipes

MAKERS OF PRINCIPAL MECHANICAL EQUIPMENT IN 1926 EXTENSION

Boilers and Auxiliaries

2—Edge-Moor Iron Co., 425 lb. pressure, 8,250-sq.ft. cross-drum boilers, with 710 sq.ft. of water-wall
2—Foster convection superheaters, designed to give 190 deg. F. superheat
2—Foster-Wheeler, 1,728-sq.ft. economizers
2—Diamond Power Specialty Corp. soot blowers, six units per boiler
Boiler arches, M. H. Detrick Co.
Firebrick, Harbison-Walker Refractories Co.
2—Ljungstrom C-16 air preheaters, induced- and forced-draft fans integral. Driven by Terry steam turbines.

Miscellaneous Material and Equipment

Boiler non-return valves, Elliott Co.
Turbine non-return valves, Schutte-Koerting Co.
400-lb. valves, Walworth Co.
250-lb. valves, Crane Co.
400-lb. pipe and fittings, M. W. Kellogg Co.
250-lb. pipe and fittings, Walworth Co.
Water-wall piping, M. W. Kellogg Co.
Feed-water regulators, Swartwout Co.
Ash gates, Beaumont Mfg. Co.
Gas flues and air ducts, Tippett & Wood.
Stack, Mead Penn Co.
Covering, Robert A. Keasby Co.
Steelwork, Pittsburgh Bridge & Iron Co., F. M. Weaver Co.

Coal-Handling Equipment

1—American Pulverizer Co. ring crusher No. 42, capacity 150 tons per hour
1—Webster Mfg. Co. 5-ton traveling weigh-larry
2—Simplex type 4-A unit pulverizers. Capacity 8,000 lb. per hr. each
4—Combustion Engineering Corp. turbulent type burners

Boiler-Feed System

2—Permutit Zeolite water softeners. Maximum capacity 25,000 gallons per hour each
3—Dean Hill Pump Co., 750-g.p.m. boiler-feed pumps, driven by Terry steam turbines
1—Elliott Co. type E open feed-water heater
Permutit continuous blowdown system, with heat exchanger

Turbines

1—General Electric Co. 4,000-kw., 3,600 r.p.m. turbine, geared to a 500 r.p.m., 3-phase, 25-cycle, 440-v., 5,000-kva. generator. Steam at throttle 415-lb. gage, 190 deg. F. superheat. Turbine arranged to extract at 150 lb. and exhaust at 20 lb. Hand regulation of 150 lb. and 20 lb. steam by gate valves on 150- and 20-lb. outlets.

Instruments

Flow meters, Republic Flow Meters Co.
Boiler meters, Bailey Meter Co.
Draft gages, Paul B. Huyette Co.
Indicating thermometers, The Foxboro Co.
Mercury thermometers, C. J. Tagliabue Mfg. Co.

Electrical Equipment

Motors, General Electric Co.
Switchboard, Westinghouse Elec. & Mfg. Co.

expected to go up the stack, thus leaving little to be removed from the furnace bottom.

The boilers are fed from river water, running three to five grains per gallon of scale-forming materials. The feed water is settled, filtered twice and then zeolite treated. It then passes to an open heater, which takes steam exhausted by the turbines driving the fans and feed-water pump. Additional steam to bring the water to 210 deg. F. is furnished from the 20-lb. line. Boiler blowoff is continuous, drawing from several points on the water walls and discharging through a heat exchanger.

When motorization of the plant was begun 20 years ago, 25-cycle 440-volt current was adopted. The investment in apparatus of this type had become so large that, when the changes were planned in 1926, it was not deemed advisable to change to 60 cycles. Current at 6,600 volts is used in some remote parts of the plant.

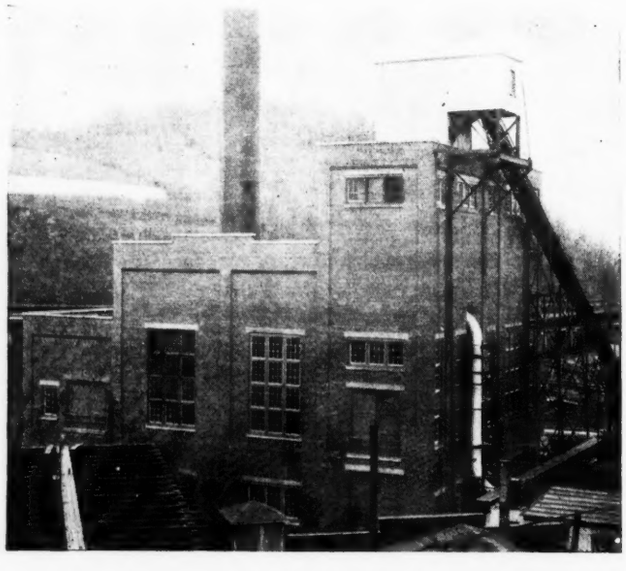
The new power unit is a 5,000-kva. machine, with a 3,600-r.p.m. steam end geared to a 750-r.p.m. generator. This machine is of the extraction type, taking steam at 410 lb., exhausting at 20 lb., and extracting at 150 lb. Its base load, normal operating condition, is 140,000 lb. steam to the throttle, 60,000 lb. through to exhaust, and 80,000 lb. bled. In case one boiler is down, the machine can deliver 3,600 kw. when exhausting 90,000 lb. to the 20-lb. line, with no steam being bled. The machine has no diaphragm, and the proportion of exhaust and extracted steam is regulated by hand.

Plant Performs as Expected

The new boiler plant went into operation about nine months from the time the decision was made to build, and furnished steam at 150 lb. for the first six months. After the high-pressure turbine was installed, the steam pressure was increased to 415 lb. The plant has been running at the designed pressure for the last six months.

Economic performance has, in general, been about as predicted by preliminary studies. In the two years since construction was begun, there have been numerous improvements in the design of water walls, burning of powdered coal and minor details. Plans are in process and work started on the addition of two more boilers.

New power house at Covington. The rear end, not shown, has a temporary wall for future extensions



Some changes will be made from the original design, the need of which has been proved by advances in the art and defects found in the present installation. The major improvements will be as follows: Coal-handling equipment will be speeded up. Coal pulverization will be finer. Somewhat higher superheat will be carried. The water-wall area of the furnaces will be increased, together with circulation pipes. Provision for dust catching will be improved, and several points showing erosion in ducts and stack by ash in the gases will be better protected. The forced- and induced-draft fans will be separated from the preheater. No copper gaskets will be used where they can be reached by treated water. Control of the feed water will be improved.

Another High-Pressure Turbine Purchased

In addition to the two new boilers in the second unit, another 4,500-kva. high-pressure turbine has been bought, virtually a duplicate of the present one, except that it has a diaphragm and grid valve. This insures greater flexibility and permits of full capacity when sending virtually no steam to the 20-lb. exhaust.

In the table are given average figures covering the monthly performance of the boilers. There is also appended a list of the principal mechanical equipment installed for the 1926-27 improvement. The design of the plant was worked out by the engineering department of the company, in collaboration with H. S. Ferguson, consulting engineer, of New York City. The construction was handled by the local engineering and construction force at the mill at Covington.

TYPICAL MONTHLY PERFORMANCE
400 LB. BOILERS

Number of boilers in service	2
Operating hours	568
Pounds of coal, as fired, per hour	13,300
Coal Analysis:	
Fixed carbon, per cent	74.19
Volatile, per cent	21.61
Ash, per cent	4.20
Moisture, per cent	2.48
Sulphur, per cent	66
B.t.u., dry basis	14,956
Evaporation, lb. per hour	146,200
Evaporation per lb. coal as fired, lb.	10.99
Steam pressure, lb.	415
Superheat, deg.	175
Temp. feed water entering economizer, deg.	205
Equivalent evaporation, lb. per hour	172,600
Equivalent evap. per lb. coal as fired, lb.	12.98
Temp. gases leaving economizers, deg.	505
Temp. gases leaving preheaters, deg.	300
Temp. air entering preheaters, deg.	80
Temp. air leaving preheaters, deg.	380
Per cent CO_2	14.6
Pulverization:	
Through 200-mesh, per cent	75
On 50-mesh, per cent	1.6
Per cent efficiency boilers, superheaters, economizers and preheaters	86.3

Make the Steam Accumulator Part of the Boiler

By Waldo Weaver

AS THE steam accumulator seems to be the present-day engineering fad, a natural question is: Why not return to the use of the fire-tube boiler or, rather, a modification of it?

The steam accumulator makes possible the operation of stokers at a uniform capacity. It enables us to take care of the peak loads without destroying the efficiency of the boiler and furnace.

It may seem foolish to suggest a return to the old fire-tube boiler after the water-tube boiler has been developed in the opposite direction; that is, reduced water and steam drum volumes for given capacities. But the fire-tube boiler actually is an accumulator as well as a heat absorber.

Experience in waste-heat recovery in steel plants has proved that the fire-tube boiler is superior to the water-tube boiler in the absorption of gases below 1,300 deg. F., and the first cost of the former is also much less than that of the latter.

The fire-tube boiler could be designed to give the same efficiency as results from a combination of water-tube surfaces and would make it possible in most installations to eliminate complicated and expensive economizers and preheaters. The advantages of both are questionable except where coal is very expensive. The use of preheated air is a moot question even in powdered-coal installations.

Some radical developments in boilers and furnaces are going on, and tests in the utilization of low-temperature waste-heat gases and the most efficient arrangement of water-tube heating surfaces exposed to the radiant heat of the furnace, prove that designs can be worked out to include the following essential elements: Water-tube surfaces around the fire; radiant-heat superheaters; fire-tube surfaces for the absorption of gases below 1,300 deg. F. This will permit the adaptation of the fire-tube boiler to provide large volumes of steam storage to furnish low-pressure steam up to 200 lb., for intermittent and variable demands for steam in process, and high-pressure steam for the power requirements in industrial plants.

Engineers are gradually awakening to the fact that bricks do absorb considerable heat and that heating surfaces should be exposed to the fire and not to useless brickwork.

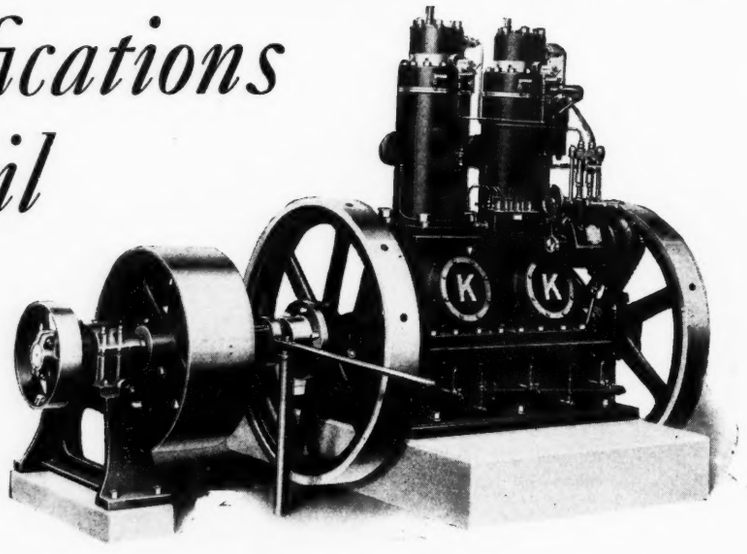
How It Would Work Out

The practical adaptation could be best illustrated with a paper mill requiring two steam pressures for process work, say 20 lb. for drying and heating and 40 to 50 lb. for beaters, rotaries and digesters. High-pressure steam at, say, 450 lb., would be drawn from the water-tube element of the boiler for power generation and lower pressure up to 200 lb. on the fire-tube element, which pressure could be drawn to as low as 50 lb. An auxiliary non-condensing turbine could be installed to utilize the low-pressure steam at an average pressure of, say, 150 lb. This would give the advantages of steam storage and make it possible to operate the main turbine condensing and eliminate the difficulties that have been experienced with the delicate governors on the bleeder-type turbines.

The auxiliary turbine, which we might call the house turbine, would make it possible to eliminate all steam-driven auxiliaries, such as turbine-driven feed pumps, exciters, condenser auxiliaries, stoker drives and exhauster. It would insure a dependable supply of process steam at the necessary pressures, even though it would be necessary to include several high-pressure stages for the use of 450-lb. steam to supply the required quantity of low-pressure steam for the various processes.

The house turbine would generate power in accordance with the demands for process steam up to the limit of its capacity, and the main condensing turbine would maintain the frequency. The ratio of capacities in the high-pressure water-tube boiler and the low-pressure fire-tube boiler would be proportioned to meet the local requirements as closely as possible.

Navy Specifications for Diesel Oil



Recommended by

H. C. DINGER
Captain United States Navy

THE matter of some standard specifications for Diesel fuel oil is receiving considerable discussion in the technical publications, and a special committee of the A.S.M.E. is taking the matter in hand. As the Navy is one of the largest consumers of Diesel oil in the country, its experience with a variety of oil engines going back twenty years or more, I suggest that the Navy specifications be used as the basis of the standard specification.

The Navy specifications for Diesel oil, designed mainly to cover fuel for submarines, have been established for a considerable period and are regarded as generally satisfactory. The main requirements are as follows:

Flash point, 150 deg.

Viscosity, not greater than 200 sec. at 32 deg. F.

Water and sediment, not more than 0.5 per cent.

Total sulphur, not more than 1.5 per cent.

Ash, not more than 0.1 per cent.

While there are set limits on undesirable ingredients, they are not unduly severe. A viscosity instead of a gravity requirement is established, for it is the viscosity and not the gravity that determines the satisfactory functioning of an oil in the engine.

This specification may not be the ideal one, but it is one that is readily met, one that refiners are familiar with, and one that will give satisfactory fuel to any Diesel engine now in operation.

In order to provide a heavier oil for large engines, a "Heavy Diesel Oil Standard" should be authorized. This should have a viscosity of 100 sec. at 77 deg. F. Saybolt furol. This corresponds to Standard Navy Bunker A, except for the requirements as to sulphur, ash, water and sediment, which are more stringent. Low water, ash and sediment contents are essential to avoid engine troubles, and the limits set can be met easily.

Would it not then be an entirely feasible procedure to adopt the Navy Specification Diesel fuel as a tentative standard? This could be used generally, and those activities requiring something more special than this would have to pay the extra costs incurred in securing it. Those plants that can use the cheaper bunker oils could do so, but it would be safer to centrifuge them first to reduce the water and sediment to proper limits, thus avoiding wear on the engine parts.

Getting the different manufacturers of Diesel engines and the different refiners to agree upon any particular specification may be a well-nigh insuperable task, but the Navy Specifications may be assumed to be impartial as between the engine manufacturer and the refiners.

With the tentative standard set up, further investigation might be made to determine what modification or additions should be made to the specifications. Some research might be done to establish the optimum requirements of an oil.

In cold climates a flash point of 140 deg. F. might be permitted, and in very hot conditions a somewhat higher flashpoint than 150 deg. might be desirable for safety. Higher flash points do not appear to be objectionable, but lower flash points are likely to produce dangerous conditions.

Baumé gravity apparently has no particular significance. The viscosity is really the determining characteristic. Gravity may vary from 30 to 20 Baumé, but some limits should be established in connection with operating temperature and viscosity.

The viscosity should not be greater than 200 sec. at 32 deg. F. Saybolt universal viscosimeter. For average conditions under warm operating temperatures, this can be increased and, under cold conditions, decreased. The viscosity may also have to be varied for engines of different sizes and design in order to secure the best results.

If a standard Diesel fuel according to these specifications were adopted, it could be used in the great majority of engines. Where certain special conditions prevail, the flash point, viscosity or amount of impurities could be changed by making a special run or by blending some other fuel oil with the Standard Diesel fuel. On the other hand, engines that will run satisfactorily on cheaper fuel could use this, either direct or by blending with the standard.

Many large Diesel engines will operate satisfactorily on Bunker A or Bunker B fuel oil. The principal objection to operating on these oils is the higher viscosity and the great amounts of sediment and water they contain. Sediment and water can be removed by centrifuging, and the viscosity can be lowered by preheating. This involves some additional expense, which may equal the difference in the cost of the oils. It is, however, believed that a standard Diesel oil would be the one generally most desirable for the majority of engines under the usual variable conditions that obtain. This particular fuel oil would be used in such large quantities that its cost would be but

slightly in excess of that of the cheaper bunker oils.

Aside from satisfactory functioning in an engine, the quality of a Diesel fuel is based on its ability to develop power. If the oil is clean and of a satisfactory viscosity for the particular engine, the power developed will be limited by the calorific value of the fuel. This is another requirement that might be set, in special specifications where particular fuel oil is desired, but which might be more or less undesirable in the standard, although a low limit of calorific value might be desirable.

It would be of particular interest and value if tests of fuel oil of different characteristics, such as asphalt content, gravity, heat content and viscosity, were actually made in a representative engine and then graded as to the power delivered. Such a series of tests would disclose those characteristics giving the best power performance.

Knowing what the optimum qualities are, we could then evaluate this against the price and operate with the particular fuel oil that produced no operating difficulties and gave the maximum power per unit of cost.

The expense of making such a comprehensive series of tests would not be great, since engines generating power for use could be employed. The extra expense would be in taking data, making examinations and evaluating the results.

The viscosity is now given in various ways in seconds at various temperatures. It is not easy to compare these, and this makes for confusion. Viscosity should be recorded as taken at certain definite temperatures; 32 deg., 77 deg. and 122 deg. F. are suggested as desirable. They happen to be the temperatures used in Specifications for Navy Fuel Oil. Some other temperatures might be used if there are any good reasons for adopting them. The Navy has been for years the largest single purchaser of fuel oils in the country, and unless there are some particular objections, such standards as have been used by the Navy might well be adopted by industry, as well as other government departments.

Letters from an Oil Engine Operator

Some Advice on Welding

Dear Ed: You say you intend to have a welding job done on an outboard bearing that has cracked. I advise you to look well into the welding man's record, for not every mechanic can make a satisfactory weld.

As I think things over, I have come to the conclusion that a man never gets too old to learn by experience. You remember I used to be engineer on the old tug "Rosalie" out in 'Frisco about thirteen years ago. We used to have quite a bit of trouble with cracked cylinder heads on the old designs of engines. These cracks always occurred in the outer shell of the water jackets, and at first we used to buy new ones whenever one gave away, because we had tried several welding companies and the weld always failed.

One day a chap came to see us and said he would weld a head and if it cracked he wouldn't charge us anything. Well, the head never cracked and we paid for the job and always thereafter we sent one of the old heads to him to fix up when we needed one.

I went up to see how he did the job and found that the important feature was the heating of the entire head before using the torch. It took him days to heat and cool the head, but only about fifteen minutes to make the weld. I had come to believe that his was the only method.

Not long after this I had two cylinder heads crack in the outer jacket. Both heads cracked at the same place between a clean-out hole on the side and the lower edge. The cracks were about three inches long, and although they did not interfere with operation I did not like the water leak on the outside of the engine. I sent for a local welder. He looked at the job and said, "Oh, yes, a very simple matter—do that in no time."

I was not so sure about that and told him so.

He brought his welding outfit on a truck. I asked him if he was not going to take the cylinder head to the shop and put it in a furnace for a few days. That, he declared, was ridiculous and entirely unnecessary. Did I think I knew more about welding than he? I was not so certain I did not. Under the circumstances I should have paid him off then and there, because I was convinced in my own mind that he was going to ruin a $450 cylinder head for me, but I let him carry on.

It took him two hours to heat one of the cylinder heads in the vicinity of the crack, and then he made the weld and covered it all over with asbestos and a canvas tarpaulin to keep out the cold air.

The next morning he came and uncovered it. It was cracked right beside the weld.

"Well," he said, "I'll take it up to the shop and put it in a furnace for a few hours."

"Not you," I told him. "I'd rather scrap it right now than to scrap it after you have increased its cost $100 without repairing it."

I got rid of him, but it was a hot argument and I paid him for the work.

I decided to repair the other cylinder head myself. I drilled a chain of holes the length of the crack, tapped them out and screwed copper plugs in, riveted them down tight and put the head back in service. It has not leaked since then.

All this simply proves that it does not pay to call in an outsider until after you have exhausted every means at your command to do the job yourself. When there is absolute need of calling for outside help, you are foolish to let him carry on when you know, through your past experience, that his methods are not correct and that he is likely to do more harm than good.

I lost $500 for my boss by letting a man that was a better talker than a mechanic undertake an important piece of work. Sincerely, E. O. Leseid.

High Pressures Again

High pressures are not confined to steam plants. The next issue will describe the highest head hydroelectric development in America. This installation, just completed in Plumas County, California, operates under a maximum static head of 2,501 ft., equivalent, roughly, to a pressure of one thousand pounds per square inch.

Making Equipment Earn Dividends In a Department Store

By Andrew F. Sheehan

BY INSTALLING a uniflow engine and a new boiler, the Forbes & Wallace department store, of Springfield, Mass., reduced power costs by $5,000 yearly. Until 1925 the power generating equipment of the store consisted of two American Ball engines with a total capacity of 300 kw. As the peak load was considerably above this, it was necessary to purchase the remainder of the power required. In winter months it was customary to carry all load possible with the engines as long as no excess exhaust was produced over the requirements of the heating system. As direct current was used, it was necessary to have a motor-generator set to convert the high-tension alternating current from the public service lines to 110-volt direct current. During the summer months it was the practice to reduce the engine load somewhat and buy more current.

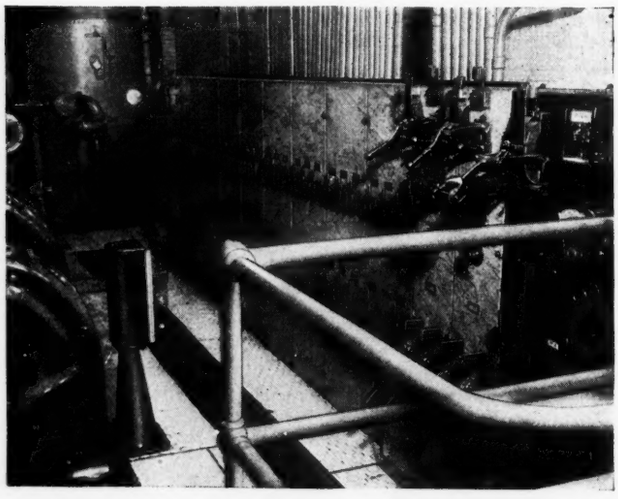


Fig. 1—The plant switchboard

Some might think that central station service exclusively during the nonheating season would prove economical, as the steam rate of single-valve engines is not very favorable, but after a little experience with this plan the reverse proved to be true. It was impossible to operate entirely on purchased current, as the service was found to be unreliable. One engine had to operate in parallel with the motor-generator set at all times during working hours, as the supply of outside current failed so often as to make the management very skeptical regarding the advantages claimed for central-station service.

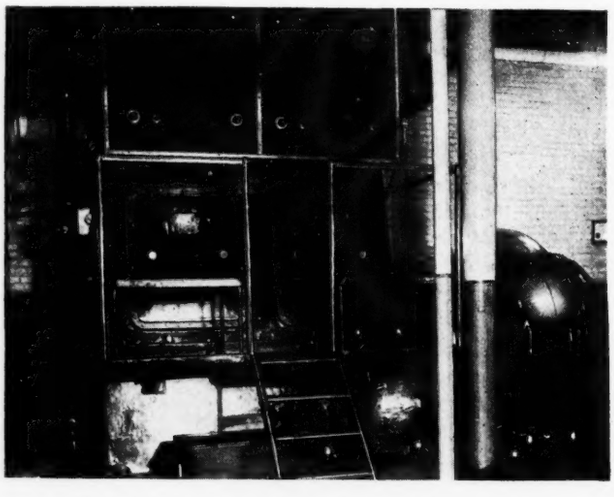


Fig. 2—The Ames vertical uniflow engine

To minimize as far as possible the annoyance caused by the motor-generator set tripping out at critical times, the chief engineer devised the plan of painting the switches red on the important circuits, and the others were painted black. When the outside current went off and the load was too heavy for the engines, the switches on the unimportant lines were pulled and the engines could then supply current where it was most needed.

For these reasons figures were secured on the cost of a 400-kw. uniflow engine generating unit, and it was found that the overhead charges on the generating unit would be less than the stand-by charge for the central-station connection. The local rates for stand-by services are $30 per kilowatt per year, with the disadvantage that on dark, stormy days when the load reaches its peak, this service cannot be depended upon. In fact, any type of generating unit would be a paying investment, as it would eliminate the outside service connection. But with the steam rate of the uniflow unit so far below the rate of the old units, the best policy is to operate it as much as possible.

The generating unit, Fig. 2, is now installed and operating, but the central-station connection has not been eliminated yet.

The boiler plant has just sufficient capacity, with no adequate spare units, and when it is necessary to take the largest boiler off the line for cleaning, a substantial part of the load must be shifted to the central station, owing to the inability of the boilers left in operation to carry the full load of the store.

But regardless of the power question, they have proceeded to install another large boiler, as an addition to the building is contemplated, which will increase the heating load. After the installation of this boiler the outside service will be an unnecessary expense and all

current will be generated on the premises, as the peak steam load is governed by the heating demand rather than the power demand.

It is also more economical to operate the uniflow unit exhausting about three-fourths of its steam to the atmosphere in summer than it is to buy this amount of current. This is due to the nature of the business conducted. Forbes & Wallace being a department store. Steam for restaurant service and washing, also refrigeration for both store and restaurant and elevator service, demand an engineer on watch. Labor costs are not increased by installing the engine, and as the engine is necessary in winter months from the economic viewpoint, no additional overhead is involved by operating it in summer. Therefore, coal is the only large item to be considered in figuring the power cost in summer.

At present coal prices and with a steam rate of 32 lb. per kw.-hr., this cost is 1.1c. per kw.-hr. The fuel consumption in winter varies with the weather and the engine load has no apparent effect in this item, except in very moderate weather.

The actual net saving to date is over $5,000 a year, and the remodeling plan is by no means completed. With the installation of the new boiler the initial pressure on the engine can be increased, which will decrease the water rate. This fact was kept in mind when ordering the engine, and clearance plates have been provided, which will be used on the engine when the pressure is increased. The plant auxiliaries are steam driven, and a further saving is possible by using motor-driven pumps for elevator service, brine circulating and boiler feeding.

I wish to point out that certain factors in this plant favored the adoption of the plans outlined here, that would not exist in many other organizations carrying on the same line of business. For instance, the plant was already equipped with stoker-fired water-tube boilers that were suitable for high-pressure service. Now, if the boilers had been of the low-pressure type with maximum operating pressure limited to 80 lb. or less, to generate current would have required a much larger initial investment, as new boilers would have had to be provided at the very start of the plan. The additional overhead would have been charged directly against the power cost, if the low-pressure boilers were good for several more years of service for heating exclusively.

In other localities lower rates may exist, which might be sufficient to swing the decision to central-station service, at least in the non-heating season. But in any business enterprise where the total net earnings on the entire investment seldom exceed 8 or 9 per cent, a generating unit is an economic necessity if it can be shown that it can earn as high as 20 per cent on the investment over and above all capital charges or overhead.

Such was the case in the plant described here, and with capital available at 6 per cent, the power generating unit has proved to be a gilt-edge investment. Giving the engine an estimated life of 20 years, it will earn for its owner over $100,000 above its cost, before it is scrapped. It is a vertical, four-cylinder unit operating at a speed of 300 r.p.m. The cylinders are cast in pairs, and it is possible to operate two cylinders condensing and two others non-condensing if a better heat balance is desired. The preliminary study of conditions to determine the advisability of installing the power unit and its subsequent installation, was made by Elmer L. Dean, chief engineer for Forbes & Wallace.

As shown in Fig. 3, the new boiler which is just being put in is a 2,500-sq.ft. water-tube of the cross-drum type. This unit has an allowable working pressure of 225 lb. For a time the operating pressure on the new boiler will be limited to 160 lb., as both boilers will be connected to a common pressure. The stoker has been removed from the old boiler and both boilers will be equipped with new hopper-feed semi-mechanical Perfection hand stokers. The boiler room is in a sub-basement, which made the task of getting the boiler into the plant rather troublesome. As it was brought in through the coal bunker a section at a time, the erection was most difficult.

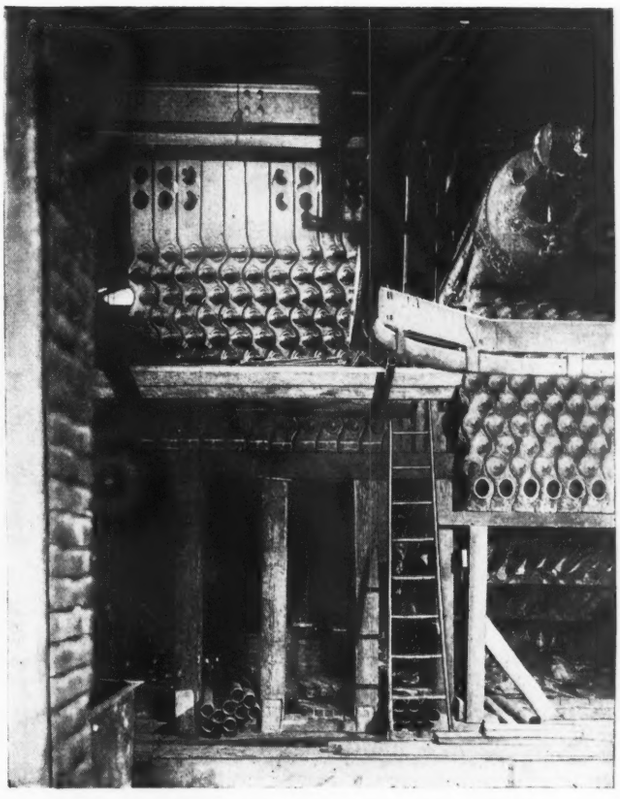
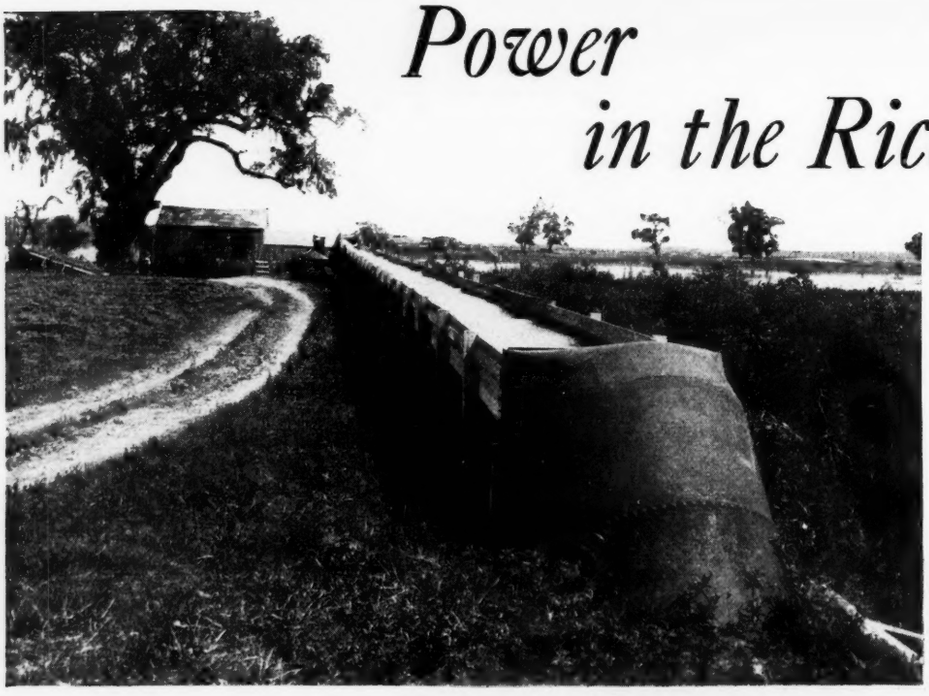


Fig. 3—Erecting a new cross-drum boiler

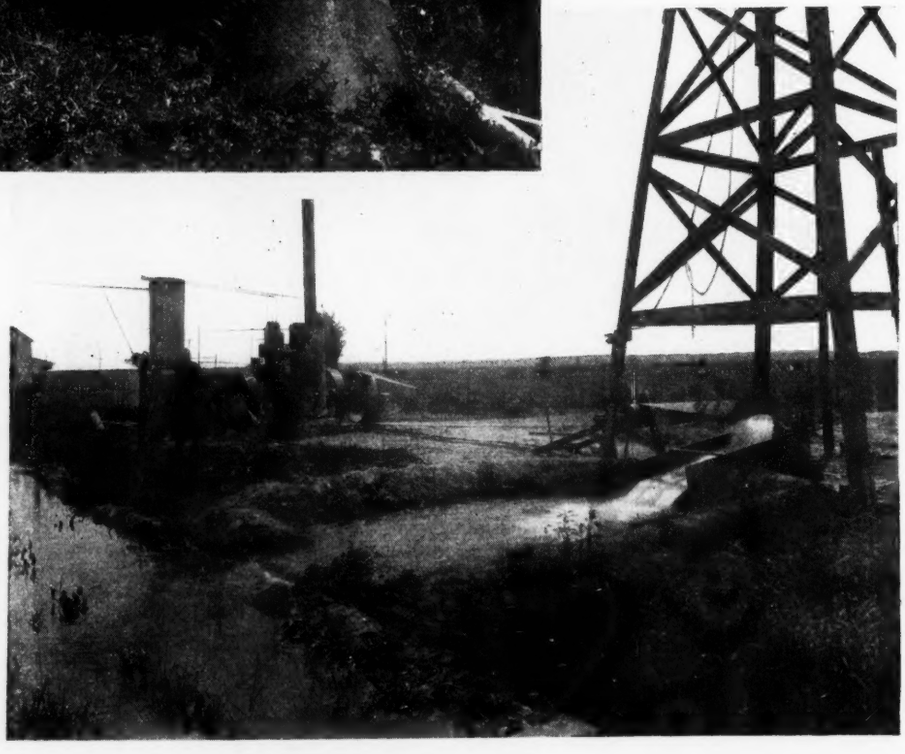
Adjustable-Speed Drive With Constant-Speed Motors

Where direct current is available the speed of motors can usually be adjusted to suit the requirements of the driven equipment. Induction and synchronous-type alternating-current motors are the most desirable from an operating viewpoint, but they are inherently constant-speed machines. The leading article of next issue will discuss systems of obtaining adjustable speed with alternating-current motors and compare adjustable-speed motors with constant-speed motors connected to variable-speed transmissions.

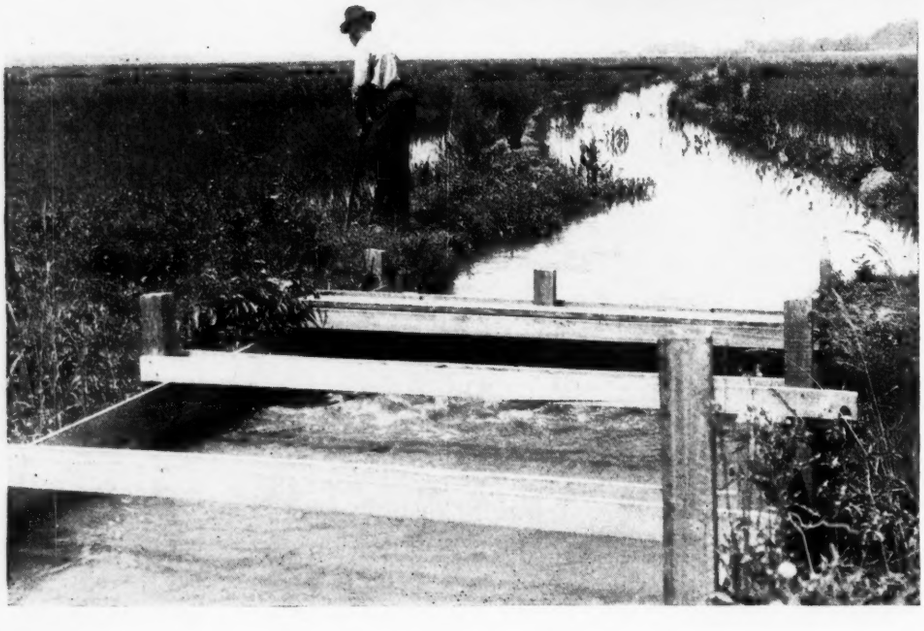
Power in the Rice Fields



Left—Water is led from the pumps by flumes



Right—An Anderson oil engine drives a vertical centrifugal pump



Left — Laterals pass the water into the fields to flood the growing rice

How ADJUSTABLE SPEED *Is Obtained*

With Direct-Current Motors

By F. A. Annett
Associate Editor, "Power"

When to use field control, armature control, mechanical speed changers or a combination of these to obtain adjustable-speed drives with direct-current motors is discussed. In a future article the application of alternating-current motors to these drives will be considered.

THERE are many industrial - power and power - house applications where it is necessary to adjust the speed to meet the different requirements of the process. Common among these are paper machines, cement kilns, machine tools, blowers, pumps, conveyors, textile machinery, stokers, etc. With direct-current motors adjustable speed may be obtained by controlling the speed of the motor, by using some form of a mechanical speed changer with a constant-speed motor, or by a combination of an adjustable-speed motor and a mechanical speed changer.

Shunt-type direct-current motors inherently lend themselves to speed adjustment, either by controlling the field current or by controlling the voltage applied to the armature. The ease with which the speed of direct-current motors can be adjusted makes it possible to obtain the necessary speed changes without mechanical speed changers except in applications where the range of speed adjustment is beyond that of the motor.

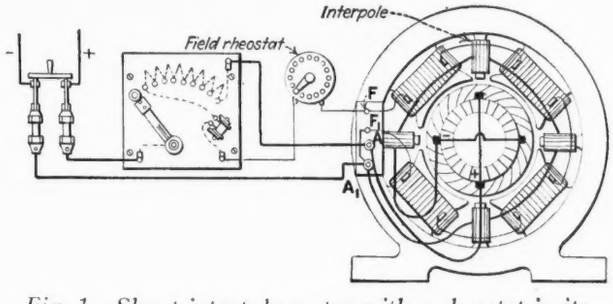


Fig. 1—Shunt-interpole motor with a rheostat in its shunt-field circuit for adjusting the speed

Induction- and synchronous-type alternating-current motors are inherently constant-speed machines. It is with these that mechanical speed changers are used most extensively to provide adjustable-speed drives. This subject will be treated in a future article, and in the following, speed adjustment with direct-current motors only will be discussed. General-purpose shunt-type direct-current motors can have their speed increased about 25 per cent by connecting a rheostat in series with the shunt-field winding, as in Fig. 1, without causing sparking at the brushes or unstable speed. With some general-purpose motors the design may be sufficiently liberal to allow 100 per cent increase in speed without getting into commutator trouble. If the normal speed of the motor is around 1,800 r.p.m., an attempt to double the speed might lead into mechanical difficulties, due to excessive armature peripheral speed. Even if the armature does not give trouble electrically, its peripheral speed should not be increased above 5,000 ft. per min. without consulting the manufacturers.

Direct-current motors designed for speed adjustment are built for ratios of speed as high as six to one by field control. Such machines must be especially designed for these applications and of the interpole on the compensated shunt type. In some applications it may be more economical to obtain speed adjustment by armature control and in others by a combination of both armature and field control.

The field current of a shunt motor generally does not exceed 3 or 4 per cent of the normal full-load input to the motor. For this reason the losses are small in a rheostat connected in the field circuit to control the speed. On the other hand, the losses in a rheostat connected in the armature circuit may be high, particularly for a constant-torque load.

The torque of a motor varies as the product of the magnetic lines in the field poles and the current in amperes in the armature. If the armature current is constant and the magnetic field is reduced by one-half, the torque will also be reduced by one-half, but the speed will be doubled. A motor's horsepower output varies as the product of its torque and speed. Therefore, from

the foregoing it will be seen that the horsepower rating of an adjustable-speed motor, with field control, is constant for all speeds. In other words, a motor designed to develop ten horsepower at 400 r.p.m. will also have the same rating if the field strength is reduced to a value where the speed is 1,200 revolutions per minute.

For direct-current motors with field control, the efficiency curves are not the same at all speeds. This difference is caused by some of the losses varying with the speed. The copper losses in the armature are about

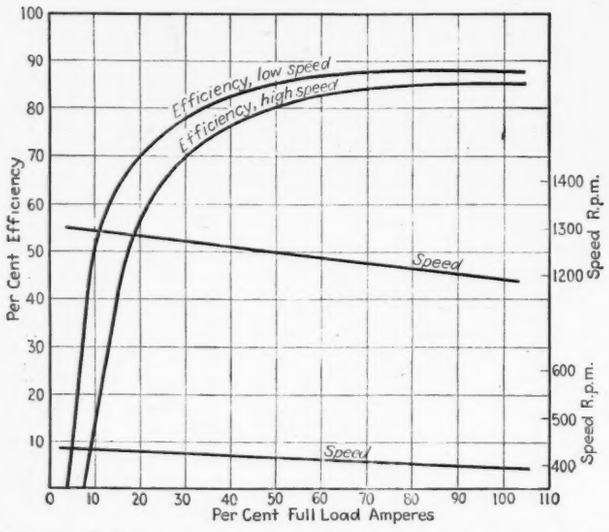
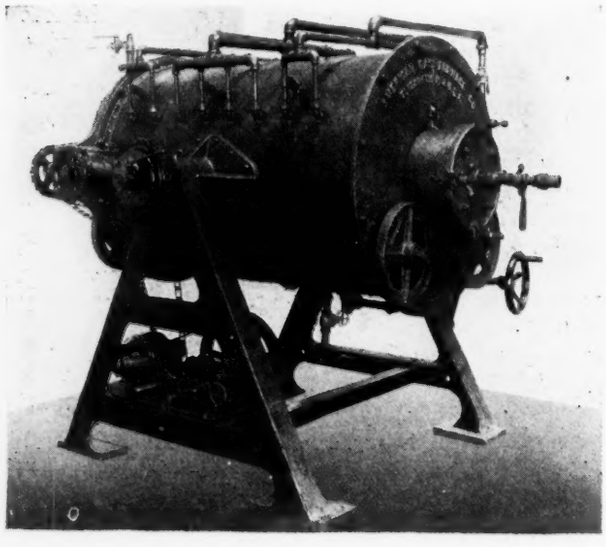


Fig. 2—Efficiency curves of a 25-hp. motor having a speed range of 400 to 1,200 r.p.m. by shunt-field control

constant. As the speed is increased, the losses in the shunt field will decrease. The iron losses due to eddy currents and hysteresis will generally increase, although this change is small, particularly with small speed ratios. Friction losses will increase almost directly as the speed, and the windage losses as the square of the speed. The net result of all these changes is an increase in the total losses with an increase in speed. The curves, Fig. 2, are representative of a motor designed for a speed ratio of three to one; 1,200 r.p.m. at high speed and 400 at slow

Fig. 3—A gas-fired annealing furnace driven by a constant-speed direct-current motor and a Reeves variable-speed transmission



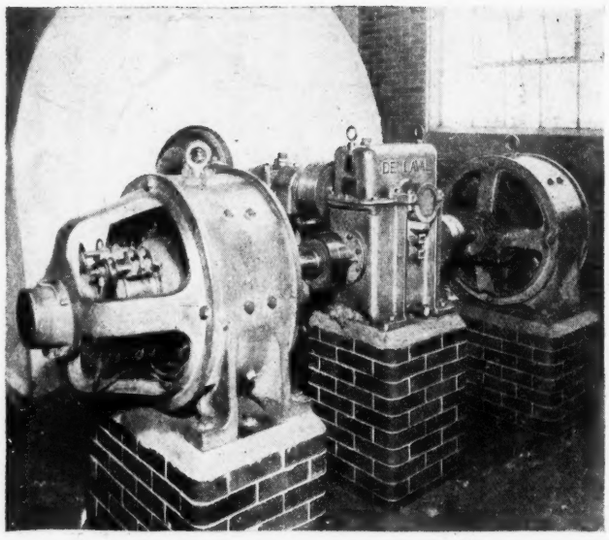


Fig. 4—Induced-draft fan driven by two adjustable-speed direct-current motors through a worm gear

The motors are connected in parallel mechanically and electrically, one motor being used until the speed makes it necessary to throw in the second motor. A great part of the time one motor is sufficient, the second being necessary only when running under peak loads. The motors are rated 20 to 25 hp. at 600 to 1,700 r.p.m. and the ratio of the worm gear is 3.625.

speed. These curves show that the greatest difference in efficiency is at part loads, and this may be a factor in the selection of the method of obtaining adjustable speed.

If the field strength of a direct-current motor is kept constant, the speed will vary directly as the voltage applied to the armature. One way of changing the voltage applied to the armature is by using a series resistance. When the resistance is all cut out of the armature circuit, the motor will operate at normal speed. Then, by cutting the resistance in circuit with the armature, the speed will be reduced.

With a constant-torque load, one-half speed is reached when the resistance connected in series with the armature is sufficient to reduce the voltage by one-half. For example, assume the input to the armature is 30 amperes at full speed when 230 volts is applied. If the torque remains constant, 30 amperes will be required at one-half speed, but the voltage across the armature must be reduced to one-half, or 115 volts. This can be done by connecting in series with the armature a resistance of $115 \div 30 = 3.83$ ohms. When operating in this way the input to the motor's armature circuit is the same as when full voltage is applied to the armature; $230 \times 30 = 6{,}900$ watts. At half speed the horsepower output is only one-half that at full speed. One-half of the power input is dissipated as heat in the armature's external resistance and does no useful work.

To control the speed of a constant-torque load in this way is inefficient and wasteful of power, particularly if the motor operates at reduced speed for a considerable part of the running period. Another objection to armature control is that constant speed for any given setting of the resistance is obtained only with constant load. For instance, in the preceding problem if, after the speed had been reduced to one-half by connecting 3.83 ohms resistance in series with the armature, the load was taken off the motor, its speed would then increase to nearly normal value. With armature control, for any given adjustment of the resistance, the speed varies almost inversely as the load. Therefore, this method of speed control is applicable to constant loads or to cases where

the motor is under the control of an operator at all times.

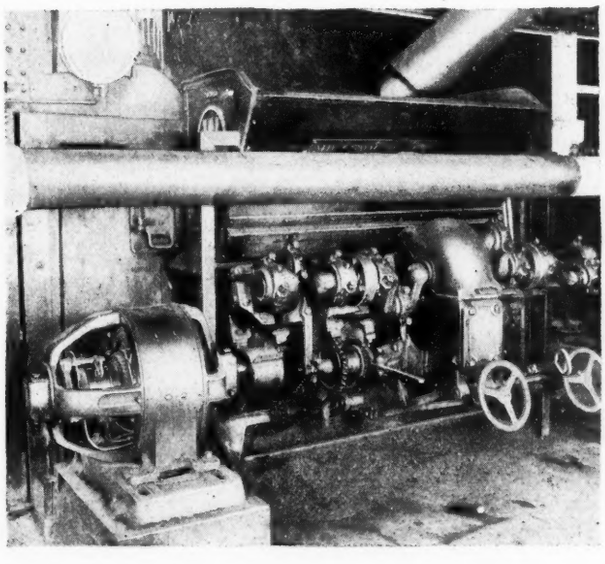
It should be noted that speed control by field adjustment is a method of increasing the speed above normal, whereas speed control by armature resistance decreases the speed below normal.

A third method of controlling the speed of a direct-current motor is by adjusting the supply voltage at the generator. This method requires a generator for each motor and is generally limited to special application where wide ranges of speed are required and where at certain times very slow speeds are necessary, such as high-speed elevator service, reversing blooming mills, large mine hoists, paper machines, and certain types of machine tools. Speed ratios of ten to one are obtained with this system.

The control of a fan's speed presents a problem that is different from that encountered in most other applications. The power required to drive a fan varies approximately as the cube of the speed. That is, a fan requiring five horsepower to drive it at 100 r.p.m. will take about 40 hp. at 200 r.p.m. Conversely, if 40 hp. is required at 200 r.p.m., the power input will drop to five horsepower at 100 r.p.m. This rapid reduction in power as the speed decreases is favorable for armature control. The maximum losses occur at about 57 per cent speed and amount to 19 per cent of the full-speed power. When the speed is reduced to one-half full value, the loss in the armature rheostat is only about 7 per cent of full-speed power. This is in comparison to 50 per cent loss for a constant-torque load, as previously mentioned.

As long as the load on an adjustable-speed motor with field control is between 50 and 100 per cent, the efficiency is high. When the load falls to around 10 per cent, as in the case of a fan operating at one-half speed, the motor's efficiency is low. Consequently, when comparing one method of speed control with another, it should be kept in mind that at low speeds both have a low efficiency. In any event the armature-control method will have the lowest efficiency. By using a combination of field and armature control, an efficiency of operation can be obtained between that of all armature control and all field control. This arrangement frequently proves the most economical.

Fig. 5—Underfeed stoker driven by an adjustable-speed direct-current motor



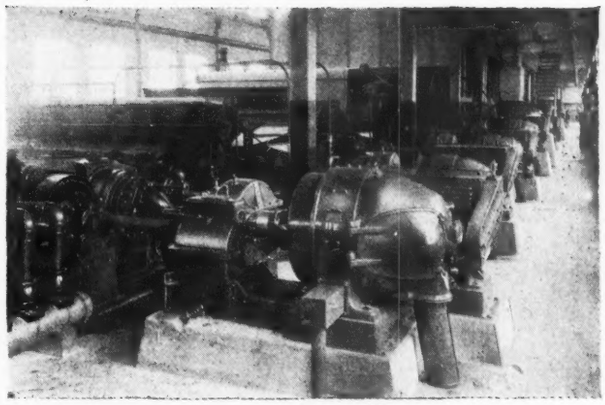


Fig. 6—Sections of paper machine driven by adjustable-speed direct-current motors

With armature control a motor for the maximum economical speed can be selected and will therefore be obtained at minimum cost. If all field control is used, the motor must be designed to operate normally at the minimum speed and will be a high-cost machine. For example, a 25-hp. 230-volt motor to operate over a speed range of 600 to 1,200 r.p.m. by field control will cost about $750, whereas a 25-hp. 850 r.p.m. will cost about $500.

If the fan is to operate for a considerable part of the time at a speed about halfway between maximum and minimum, the most economical arrangement may be found in selecting a motor that normally will drive it at this speed. For higher speeds field control may be used and for speeds below normal armature resistance control applied.

Where a fan is to operate at slow speeds for a large part of the time, it may be found economical to use two motors, having a combined capacity equal to that required to drive the fan at maximum speed. Such an arrangement is shown in Fig. 4. At low speed one motor drives the fan. When the speed is increased to where the load is greater than the capacity of one motor, the second motor is brought into operation and the fields of both motors weakened to give the higher ranges of speed. This arrangement not only allows operating at a higher efficiency than if only one large motor were used, but greater reliability is obtained. In the lower speed range two motors are available for driving the fan, and if one fails the other may be brought into use.

In such applications as machine tools, where the load is intermittent, only field control is suited, since, when the load is taken off the motor, the speed would increase to nearly normal value if armature resistance control were used. For conveyor applications and others having practically a constant torque, armature control will be uneconomical on account of the large losses in the external resistance. In these applications field control is the best suited. If the speed range required is beyond that of an adjustable-speed motor, it may be a more economical proposition to use some form of mechanical speed changer in combination with a constant-speed motor operating at the maximum economical speed. In other applications a multi-speed gear or a cone pulley drive in combination with an adjustable-speed motor may prove the most economical.

Multi-voltage in combination with field control has been used to obtain adjustable speed. For example, 115 volts is applied to the armature and 230 to the field coils

to obtain, say 300 r.p.m. The field control is then used for speed ranges up to 600 r.p.m. Then the armature is connected to 230 volts and with full field 600 r.p.m. is obtained. By again weakening the field, the speed can be increased to 1,200 r.p.m. This makes it possible to obtain a four to one speed range, with a motor designed for a two to one range by field control. If a motor having a normal speed range of four to one is used on a two-voltage circuit, a speed range of eight to one can be obtained.

Where very low speeds are required for short periods, such as in elevator application, a combination series-and-

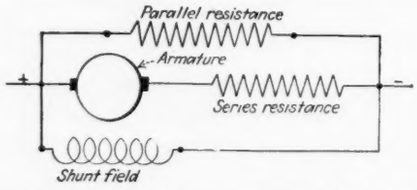


Fig. 7—Diagram of series-parallel-resistance armature speed control

parallel armature-resistance method may be used. In this case a resistance is connected in series with the armature and another connected in parallel with the armature and series resistance, as in Fig. 7. This method is wasteful of power and is suitable for application only where it is required to reduce the speed of the motor to a very low value for short periods.

Water Won't Hurt Leather Belts If They Are Dried Out Properly

By Roy C. Moore
Chief Engineer, Chas. A. Schieren Company

MANY persons have had a pair of wet shoes to dry out only to find that when they had dried they were stiff and the leather cracked when it was sharply bent. The reason is that the fibers of oak-tanned leather containing oils or animal fats in small quantities will burn at temperatures of 80 deg. F. when dried too rapidly. This burning of the fibers leaves the leather brittle and destroys its strength, so that it can never be brought back to its original condition.

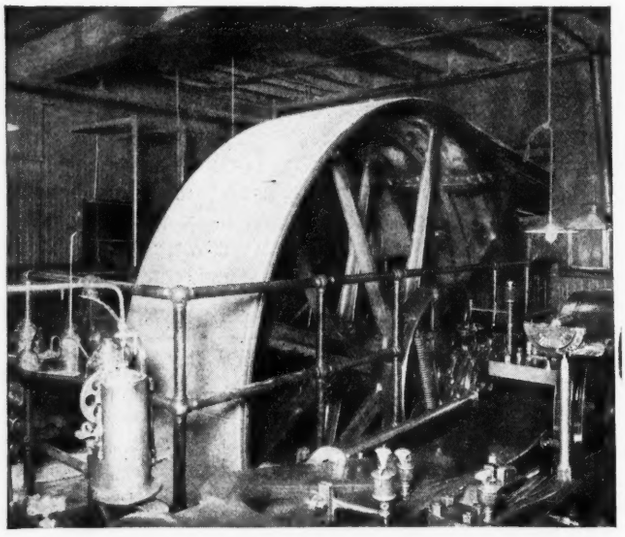
If there is a liberal amount of oil in the leather, especially on the surface, the rate of drying is slowed up to a point where, under normal room temperatures, the fibers are not injured. Many people try to dry out water-soaked belts too quickly with always the same result. Water-soaked belts should be dried very slowly, at moderate temperatures, preferably at 60 deg. F., and never higher than 80 degrees.

A good process to follow after a thorough soaking, if the belt need not be run, is to paint it inside and out with a light coat of neat's-foot oil, cod oil, or a belt dressing made by the manufacturer of the belt. When applying this oil to the surface of the leather, be sure to turn the pulleys so the part of the belt that was in contact with the pulleys will also receive an application. The belt should then be allowed to stand until it is well dried. This may require 48 hours or more, depending upon atmospheric conditions in the room.

If the drive cannot be shut down for the drying-out period, under no conditions should the belt be run until its surfaces have been treated.

At times necessity dictates the use of sticky materials to make a belt pull when it is impossible to shut down for the drying-out period. Rosin, for instance, will build up a temporary surface on the belt until it has had time to dry out, but it should be scraped off as soon as conditions will permit, since it is injurious to leather. Emergency measures of this sort must be resorted to at times, but they should be used only as a last effort. A spare belt, to be used in instances of this kind, would save many a tie-up and prevent injury to the water-soaked belt.

Belts in which waterproof cement has been used in the laps and plies will not come apart no matter how wet they get. Belts in which regular cement has been used will often pull apart in laps and plies because this type of cement is soluble in water. It is always best to run



Sixty-inch belt that was wet and dried out without being injured

regular cemented belts off the pulleys in order to relieve them of all strain while being dried out. The laps will not open up if this is done immediately and before the cement has been softened. If this is not done, it may be necessary to rebuild the belt completely after it has dried out.

Many interesting cases are on record of water-soaked belts which, because of proper care, appeared to be in better condition after the wetting than before. About four years ago the Flint Kote Company, of Little Ferry, N. Y., had some trouble in its beater room that made it necessary to flood the stock. A 60-in., three-ply main-drive belt, shown in the figure, operating in this part of the room had the lower strand completely submerged in water, mud and stock from the beaters. Workmen shoveled from six inches to a foot of material off the belt before any attempt could be made to dry it out. As soon as the belt could be dug out and the muck washed off, the surfaces, both inside and out, were thoroughly dressed with Natural Grip belt dressing, which allowed the leather to dry slowly. Since waterproof cement had been used in building this belt, it was not necessary to pay any attention to that part of the construction.

After a thorough drying the engineer reported that he believed the belt to be in better condition than before the accident in the beater room. After four years of service the belt appears to be in just as good condition as the day it was installed. The wetting did not hurt it because it was dried out properly.

A Fast Job of Boiler Remodeling

By W. R. McCann

Chief Construction Engineer, Atmospheric Nitrogen Corp.

AN URGENT necessity of maintaining 24-hour steam supply continuously at its plant in Syracuse, New York, forced the Atmospheric Nitrogen Corporation to make over its boiler plant, doubling the capacity, in a time so short that records, perhaps, were shattered.

To obtain increased capacity and better economy without installing a third boiler, it was decided to restoker two 5,020-sq.ft. Stirling boilers, removing the old-type stokers and substituting longer stokers of modern type. This work was done on a bonus and penalty contract.

The boilers were in battery and only one could be spared at a time, for the load was constant and the plant was operated 24 hours daily. No change was made in the boilers and superheaters other than maintenance.

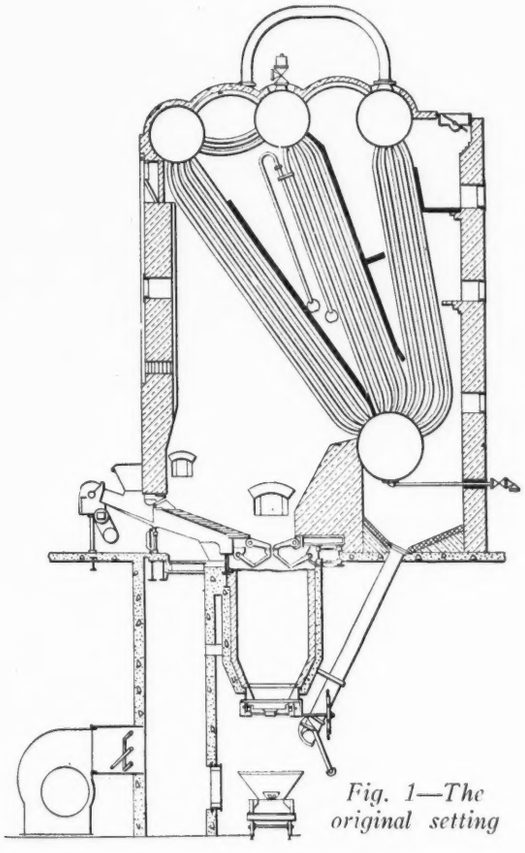


Fig. 1—The original setting

The furnace volume was increased 23 per cent, from 1,212 to 1,490 cu.ft., while the projected grate area was increased from 71.5 to 103 sq.ft. The stokers were lengthened from 8 ft. 1 in. to 11 ft. 9 in. and the bridge wall moved back 3 ft. 8 in. Electric motors replaced the steam engines driving the stokers, and new ash hoppers were installed.

It was found that the boiler rating increased from 127 per cent to 250 per cent on 13,500-B.t.u. coal. The equivalent increase of capacity was equal to a third boiler of an estimated cost of $50,000. The increased economy of the new stokers compared to the old type was 8 per cent. The original setting is shown in Fig. 1 while Fig. 2 shows the new layout.

The work on one unit, as scheduled in the contract and as actually done is listed in the tabulation.

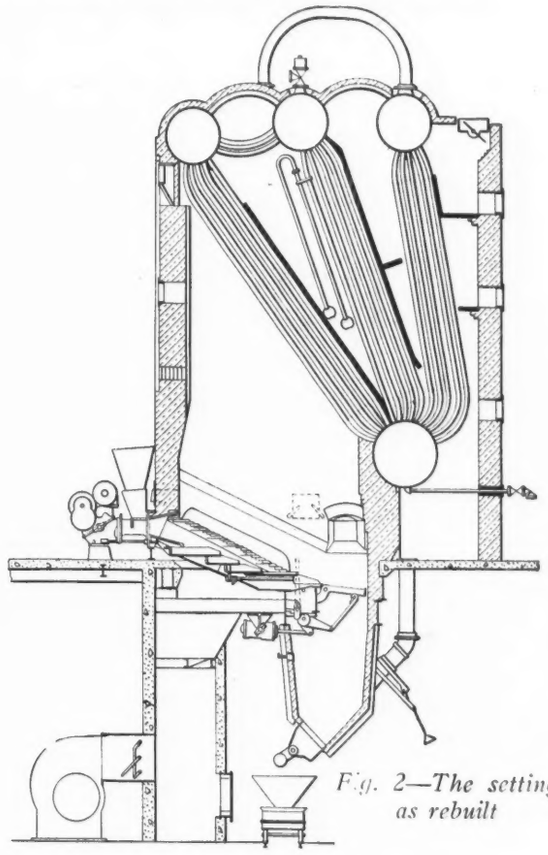


Fig. 2—The setting as rebuilt

SCHEDULE FOR INSTALLING STOKER	REPORT OF WORK ACCOMPLISHED
First Day	*First Day*
Boiler cooling off.	Coal hopper 100 per cent removed.
	Concrete ash hopper 40 per cent removed.
	Old brick 40 per cent removed.
	Old stoker 80 per cent removed.
	Common air chamber blocked off.
Second Day	*Second Day*
Remove old coal hopper.	Finished removing concrete ash hopper.
Remove concrete ash hopper.	Finished removing old stoker.
Remove old bridge wall; front wall to relieving arch and portion of side wall lining.	Old supporting steel 80 per cent removed.
Remove present stoker.	Old brick 80 per cent removed.
Third Day	*Third Day*
Remove old supporting steel.	Old steel completely removed.
Erect new supporting steel.	New steel erected 100 per cent.
	New steel ash hopper 50 per cent erected.
Fourth Day	*Fourth Day*
Erect new steel ash hopper.	New ash hopper erected.
Erect steam cylinders.	Steam cylinders erected.
Erect new metal air duct.	Metal air duct erected.
Erect party wall lining.	Finished removing bridge wall and old lining.
Fifth Day	*Fifth Day*
Partially erect new stoker.	New stoker 35 per cent erected.
Build new rear wall.	Metal air duct 75 per cent completed.
Erect pier for drive.	Brick lining for ash hopper placed.
Sixth Day	*Sixth Day*
Finish erecting stoker.	Stoker 90 per cent completed.
Place lining for ash hopper.	Finished erecting air duct.
Install new doors.	Rear wall, side wall lining and front wall 75 per cent completed.
Seventh Day	*Seventh Day*
Build front wall to relieving arch.	Stoker installation completed.
Erect stoker motor.	All brickwork completed.
Erect stoker drive.	Motor and motor drive completed.
Erect 3-way valve plate.	Three-way valve plate completed.

Two days additional were required for drying out, and the second stoker was installed in six days.

Power is indebted to the American Engineering Co., for this information.

Pneumatic Coal Handling

Saves $6,000 a Year

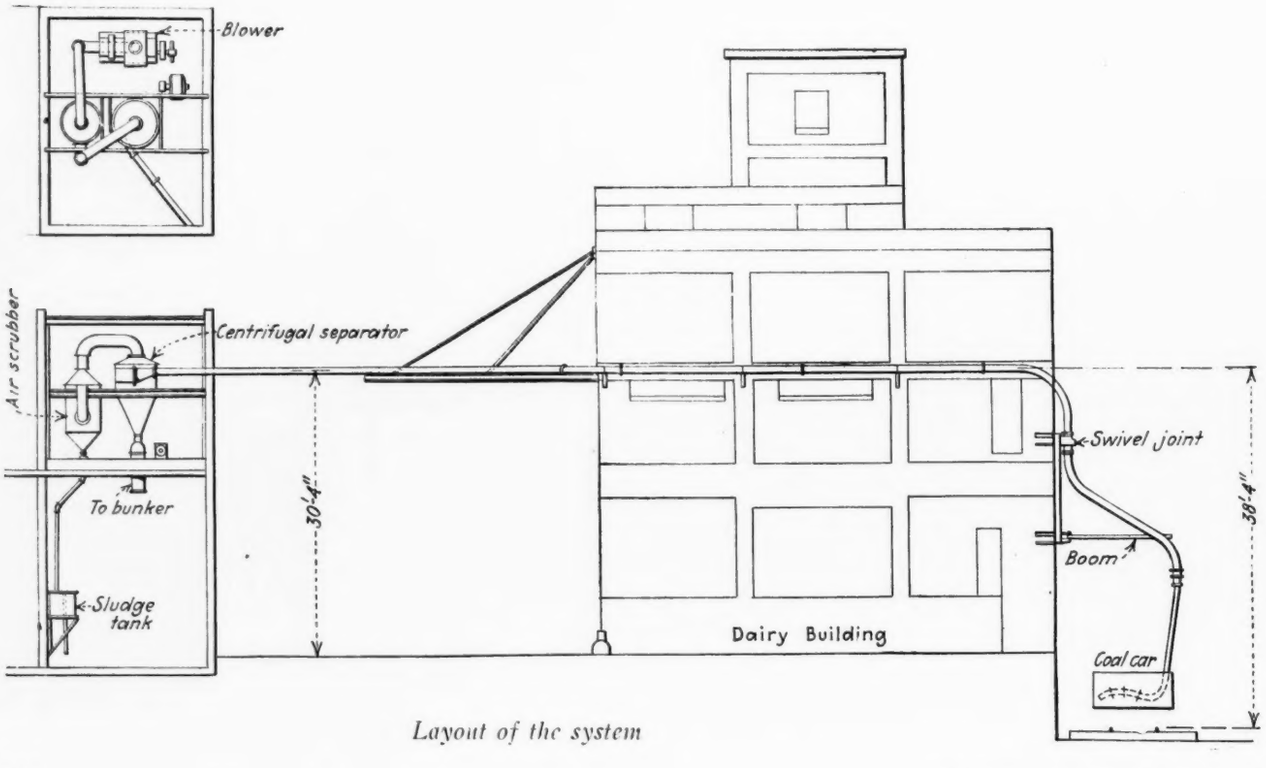
IN ADDITION to permitting the purchase of coal in carload lots, this system insured, by the elimination of coal dust, the cleanliness necessary in the dairy buildings.

Coal is being drawn up through the heavy hose

AT THE plant of the Page Dairy Company, the largest maker of dairy products in Toledo, Ohio, cleanliness is the watchwoard and the maintenance of highly sanitary conditions throughout the entire establishment is a slogan prominently advertised by the management. Although current is purchased for light and power, the company operates a boiler plant for heating the process steam, and to drive a reserve generating set in case of emergency. Motor-operated ammonia compressors supply the large demand for refrigeration.

In the course of a year about 6,000 tons of coal is consumed in the boiler plant. As the latter is over 130 ft. distant from the railway siding, in the past coal had been delivered by auto trucks. Its unloading occasioned more or less dust, which was undesirable in the vicinity of a dairy plant, so it was decided to install a coal-handling system that would eliminate this nuisance, and by extending it from the railway siding to the boiler room make it possible to purchase coal in carload lots at considerably less cost.

Owing to advantages in flexibility, freedom from dust,



Layout of the system

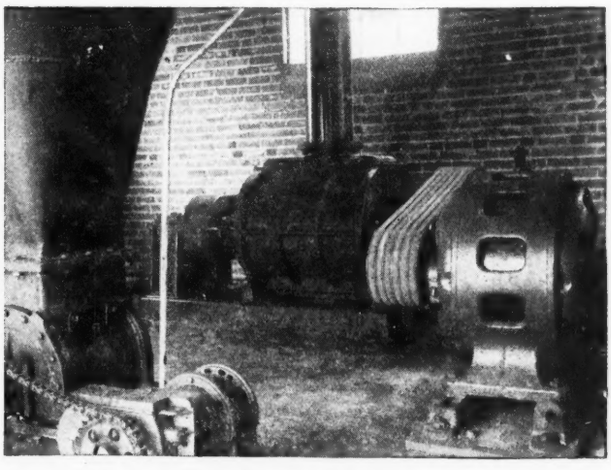
convenience in installation and minimum labor requirements, a fully inclosed pneumatic system of coal handling was selected. No track hopper or conveyor gallery was required, and as the conveyance of the coal from the car to the pneumatic plant, placed in a room above the coal bunker, could be effected through a pipe line, the installation problem was one of the simplest.

The Brady Conveyors Corporation, of Chicago, was called upon to design, build and install the pneumatic system. An initial cost of $9,000 for the installation was not considered excessive, as in addition to the other advantages mentioned, a saving estimated by the Page management as $1 per ton, through cheaper coal, when buying in carload lots, and less labor, made it possible to pay for the equipment in eighteen months.

Reference to the accompanying illustrations shows the system to consist of an 8-in. pipe line, centrifugal separator and vacuum chamber, an air scrubber to eliminate the dust and a Root type blower "Tex" rope driven by a 40-hp. motor. Coal is drawn from the car through a flexible wire-inserted rubber hose hung from a swivel joint provided with ball bearings. The hose passes over the end of a boom which can be swung sideways to clear the track when not in use or swung out over the car when it is desired to unload coal. A 6-in. nozzle permits coal of large size to be drawn into the pipe line, where it passes through an over-all distance of 170 ft. to the dust separating plant.

Entering the centrifugal separator tangentially at high velocity, the heavier particles of coal whirl around the circumference and settle to the bottom of the receptacle, from which they are delivered to the bunker immediately below by an airtight rotary discharger chain-driven by a 1-hp. motor equipped with a speed reducer. The fine coal dust passes to the center of the separator and is drawn off at the top to an air scrubber provided with water sprays and a layer of filtering material having the added faculty of drying the air before it passes to the vacuum pump or blower, and is discharged to the atmosphere. The dust, caught by the water, is washed down to a sludge tank, from which the coal is reclaimed and the waste water drained to the sewer.

Although the guaranteed rating of the system is 15 tons per hour, 65-ton cars have been unloaded at the plant in 3½ hours, which is equivalent to 18.6 tons per hour. Exclusive of overhead and maintenance, sufficient time not having elapsed to know the latter, the operating cost per ton of coal handled is comparatively low. On a capacity basis of 15 tons an hour and the use of 30 kw.-hr. an hour, the cost of power at 1½c. a kw.-hr. averages 3c. a ton; labor at 50c. an hour averages 3.33c. a ton, making a total including minor supplies, approximately 7c. a ton of coal. Taking the entire overhead, including interest, depreciation and the other usual items, at 12 per cent, the overhead charge for the year would total $1,080, which reduces to 18c. a ton of coal handled. Adding the fixed charges to the operating cost gives a total figure per ton of 25c. The plant has been in operation for several months and thorough satisfaction is expressed with its operation.



Receiving end of line

Practice of Removing Valve Wheels Not a Safe One

IT IS common practice around plants for someone connected with the engineering department to remove the handwheels from valves on the steam lines and on some of the other pipe systems. This is done to prevent unauthorized persons from tampering with the system; this sort of thing is encountered largely in cases where exhaust steam is used for heating. The same custom of removing wheels is followed in office and public buildings.

Whether such practice does not defeat its own ends is an open question. The naked valve stem is almost as much of an invitation to the mischief maker as is the wheel supposed to be there. And if a person really wants to turn the valve, he can do so with a wrench or pliers. It must be concluded that the gains do not outweigh the losses—the inventory or appraisal value of a system is not so high with wheels gone, the system is not so quick acting, and the cost of replacing all the wheels and supplying new ones for those lost is directly against it.

In one plant every valve is stripped but the wheels are hung on nails driven in the wall in some convenient place within sight. Another amusing incident occurred in a little machine shop where I once worked. The room was 40x40, and over in one corner was an upright boiler and a 10-hp. engine that ran the machines.

Our "engineer" was great for small economies and kinks. He had been annoyed by having the heating valves tampered with when his back was turned, so he removed all the wheels. He went one step farther and took the handwheel off the throttle valve on the engine. This rounded out a system of which he was complete master. The wheel of the throttle valve he kept in a drawer under his bench, one wheel of the main steam valve he carried in his jumper pocket, and all the rest he had "buried."

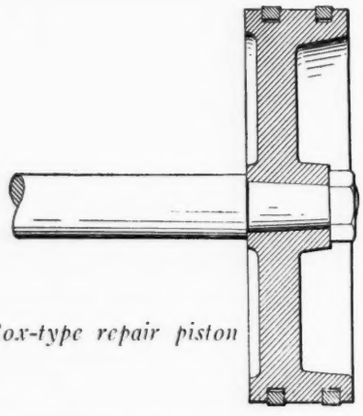
One day some changes were being made and the bench was being moved, too. The drawers had been taken out to lighten it. Just at that time, of course, the governer belt had to break. Somebody shouted the news, and the engineer made a dash for the engine. There was no handwheel on the throttle, so he made a dive for the drawer that had been moved. Things were jumbled up and he threw out the contents pell-mell trying to find the wheel. But the wheel was missing. Meanwhile, the engine was dancing up and down and the belts were racing. Finally, while he stood in the middle of the floor, waving his arms, completely confused, some level head closed the throttle with a wrench. After that incident all the valve wheels went back on the stems and stayed there.

Right Out of the Plant

BOILED-DOWN EXPERIENCE PASSED ALONG TO THOSE WHO MUST SAVE MONEY, IMPROVE THE PRODUCT AND KEEP THE PLANT RUNNING

Improved Pistons for Small Steam Engines

IN A machine shop in central New York that does a great deal of steam-engine work, they follow a plan of replacement that is of interest. Whenever a piston has to be overhauled so much that new castings are required, they replace the older type with a lighter and



Box-type repair piston

simpler design. Quite often it is possible to show the owner that a new piston will be almost as cheap as the replacement of a bull ring or follower plate alone.

This shop replaces all the solid and built-up pistons with what is termed a "box" piston, as shown by the drawing. This was long a popular design when locomotives were smaller; it is simple, strong and not expensive to make. For these stationary engine jobs, the shop in question follows this practice up to 16-in. diameter pistons. Snap rings are used, and they prove as satisfactory as the rest of the job.

There is no reason why the thought back of this practice should not be extended to other jobs of repair work. If, in making a repair, the benefit of modern design or better materials or some practice founded on research can be included, the work is improved just that much. It may mean an economy in operation of the unit or greater life from a given repair job. In any case let a modern line of thought be applied to the work, even if the unit itself is old. DONALD A. HAMPSON.

Middletown, N. Y.

Grounding Electric Light and Power Circuits

A GROUND on each side of a circuit forms an additional path for current to flow through, the amount depending on the voltage and the resistance. Frequently, the ground current is sufficient to open the protective device, but in some cases the resistance of the ground is high enough to keep the current within normal limits.

A ground on each side of the circuit on the load side of a wattmeter will cause the reading to be high. If the two grounds happen to be on the same side of the circuit, one ahead and one back of the meter's series coils, these coils will be shunted and a low registration result.

Power companies making a practice of grounding their systems have rules covering the proper installation of meters so that the registration may not be affected by accidental grounds. The effectiveness of this system depends on low ground resistance. This generally can be obtained where connections are made to extensive underground piping systems. Where pipe and plate grounds only can be made, the resistance to earth may be high and the effectiveness of the ground connections reduced.

Many persons oppose the practice of grounding because they consider that both life and fire hazards are increased. The present method of polarizing all circuits and devices, together with proper fusing, should reduce these hazards below those on ungrounded systems. As yet our company has not made the practice of system grounding general, so that we have considerable trouble from accidental grounds, especially in solid and flexible metallic conduits.

In some cases grounds on the line have made watt-hour meters run backward. The figure shows an installation in which peculiar effects of grounds were noticed. Owing to the resistance of the conductor between *X* and *Z*, with

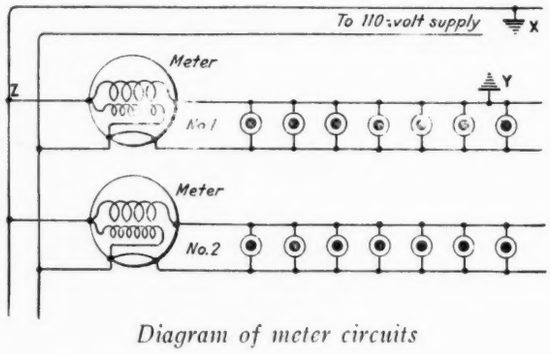


Diagram of meter circuits

load on No. 2 circuit and none on No. 1, meter No. 1 ran backward. The current divided between the paths *XZ* and *XYZ*. The latter circuit reverses the direction of the current through the meter's current coil and causes backward rotation. When the load on circuit No. 1 is increased, the meter slows down and when the load reaches a certain value it stops, at which time the series coils are completely shunted. As the load on No. 1 increases as compared to No. 2, either by an increase in No. 1 or a reduction in No. 2, or both, the meter runs forward but not so fast as it should, because of the shunting effect of the grounds.

The polarity of the meter's potential circuit always remains the same, while that of its series circuit changes with the direction of the current, thus accounting for the actions observed.

In this instance temporary corrections were made by transposing the wires on both sides of the meters. If

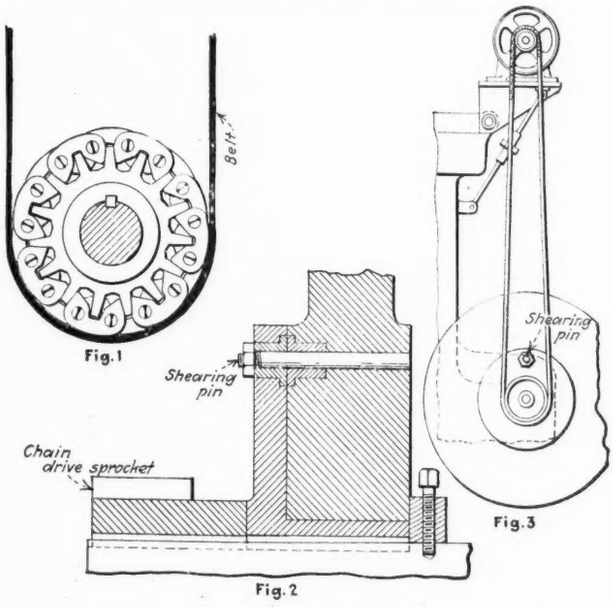
this had been a three-wire installation with the usual types of three-wire meters, temporary corrections could not have been made in this manner, so that immediate removal of the accidental grounds would have been necessary. This experience leaves me of the opinion that after all conditions are considered, effectively grounding the system at every service, as well as at intervals along the line, is the correct practice.

HENRY MULFORD,
Patchogue Electric Light Company
Patchogue, N. Y.

How a Silent Chain Drive Was Changed to Belt Drive in an Emergency

THE value of keeping adequate repair parts on hand was brought home to us a short time ago, during a rush period, when the silent chain on one of our principal machines was damaged, throwing the machine out of operation.

A 20-hp. motor was mounted on the top of the machine and the drive was practically vertical, as shown in Fig. 3. The chain sprocket was arranged to drive the machine through a shearing pin having a nut on the outer end, as shown in Fig. 2. The pin was a fairly good fit in the hole and generally, when it did shear, the pieces would stay in place until the machine was stopped and the pieces withdrawn or driven out. On one occasion, however, for some unknown reason the short end of the pin



Arrangement of chain drive and shearing pin

with the nut fell out, when the pin sheared and dropped into the sprocket, causing serious damage to the chain over a length of about 40 in.

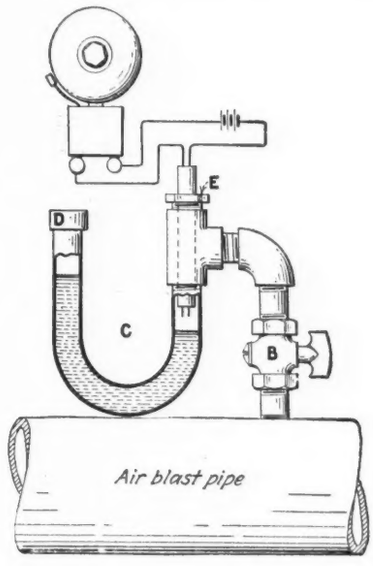
As there was no spare chain in stock and the machine had to be kept in operation, some other means of driving it had to be devised.

Our maintenance man suggested wrapping each sprocket with a piece of the chain taken from the undamaged section and using a belt, as shown in Fig. 1. This was quickly done and the machine was back in operation (although with reduced output) in a short time and was operated with this drive for about a week until a new chain was obtained.

G. I. WILLIAMSON.
Chicago, Ill.

Gas Furnace Alarm

GAS furnaces require much low-pressure air, which is generally supplied by pressure blowers. Usually, from seven to eight times as much air as gas is required, depending upon the richness of the gas. For the purpose of keeping furnaces, muffles, etc., hot when not in



U-tube mercury alarm to indicate stoppage of air flow

use, as during nights, Sundays and holidays, the burners are turned down as low as possible and allowed to run straight through.

If there is sufficient draft to the furnace, the fan may not be required at such times, but in many cases the fan blast is desirable. The draft to the furnaces should be just sufficient to carry away the products of combustion. Under certain conditions the fan may stop, as from a fuse blowing, belt, starting-box or power-house trouble. At such times, if no one is at hand to turn off the gas, some of it may make its way back into the blower pipes. This mixture of gas and air finally becomes rich enough to explode and when it does, considerable damage usually is the result.

To prevent such a contingency, the simple device shown in the illustration, for sounding an alarm the moment the flow of air to the furnace is interrupted, has been used. Through cock *B*, with nipples, elbow and tee connection is made between the blast pipe and the U-shaped bent tube *C*. The attachment to the blast pipe can be made by soldering and reinforcing before boring the hole, or the device can be hung on the wall and connection made with a rubber tube. Into the lower end of the tee is screwed the bent pipe *C* which is partly filled with mercury. The open end of the tube has a cap *D* loosely sitting over it, while bushing *E* is screwed into the upper end of the tee. Through this bushing two wires lead downward into the tubes. The other ends of the wires lead to an electric bell and battery, which may be placed at any convenient point and if desired two or more bells may be connected in the circuit.

While there is pressure in the blast pipe, the mercury in the bent pipe *C* will be depressed away from the wires. If, however, the pressure fails, the mercury will equalize in the two legs of the tube, short-circuiting the wires and causing the alarm to sound.

W. L. PARKER.
Elgin, Ill.

As the Other Fellow Sees It

WHERE THE MAN WHO AGREES OR DISAGREES WITH AUTHORS OR EDITORS HAS A CHANCE TO SPEAK UP

Imagine the Savings

RECENT editorials entitled "Imagine the Savings" and the letter by Waldo Weaver in the August 28 issue on the same subject were very much to the point; for undoubtedly great savings are possible in the majority of power plants. It is doubtful if there has ever been a period in which there has been more real waste than at the present. To meet these conditions in power plants and factories today, prevention and recovery of wastes are of vital importance. Means must, therefore, be taken to utilize every piece of scrap possible. Scrapped materials can, in almost all cases, be recovered at least in part.

An apparatus that has proved profitable in many power plants in preventing unnecessary waste of material is the oxyacetylene outfit. This apparatus is completely self-contained and lends itself as a portable tool. It can be safely said that many thousand dollars worth of valuable castings, pumps, compressors, gear wheels, tanks, valves, pipes, machine parts and tools are now reclaimed from the scrap heap by autogenous welding methods. Probably no other apparatus introduced in power-plant maintenance during recent years has made possible greater savings, since its ability to reclaim worn or broken metal parts has effected large savings in material without increase in labor costs, and has made it unnecessary to buy and carry in stock many of the most expensive parts. In fact, in some instances, storerooms have been replenished from the scrap heap. Operations on metal parts large and small are handled easily, quickly and economically by autogenous welding. In most cases joints can be reinforced to give added strength if desired.

It is impossible to enumerate in detail all the work dealt with in power plants by autogenous welding, but the following are some applications: The repair of boilers, compressors, pumps, valves, gear wheels, tanks, pipes, fans, etc.

The welding operator should bear in mind that any repair job to be welded in the power plant must be properly prepared, cleaned, lined up, etc., before the torch is applied. In repairing steel parts oxidation is the most serious defect, and it must be reduced to a minimum by using first-class torches, well regulated and properly handled. A welding rod especially manufactured for welding steel should be used. Repairs to ruptured or broken pipes and other cast-iron products—also malleable-iron parts—are most satisfactorily effected by bronze welding. Owing to the fact that extensive preheating is unnecessary, bronze welding often saves dismantling the broken machine, and also permits rapid handling of miscellaneous parts to be welded.

Judgment, of course, must be used in power plants in determining upon the repair or utilization of material that would otherwise be scrapped. If the repairs cost more than new parts, which sometimes happens, especially if the repair work is inefficiently conducted, it is obviously cheaper to scrap the parts. Great savings can be effected in power plants by a careful study of lubricating oils and cutting fluids employed, and the methods in handling and using them. Modern apparatus should be installed for cleaning oily cloths and wipers so they can be used over again, and reclaiming the oil. One railroad company in Great Britain spends more than £4,000,000 per annum on locomotive coal. "Imagine the savings" if each engine burned one pound less per mile; the coal bill would be reduced by £70,000.

In conclusion, it may be safely stated that co-ordinated effort is the greatest preventive of waste. We must exercise the most rigid economy in power plants in utilization of all kinds of materials. "Imagine the Savings" that will accumulate if every power plant engineer or workman puts into practice the following don'ts.

Don't waste coal, coke or any other fuels.

Don't waste electric light, gas or any other illuminant.

Don't waste water.

Don't waste metals of any kind, because there is an imperative need for rigid economy in the use of metals.

Don't use high-priced materials for any job when lower-priced materials will function equally well.

Don't fail to make war on all waste; handle work carefully.

Don't forget material conservation in the power plant must be the consistent aim of all employees; the world is learning the need of it.

E. ANDREWS.

Manchester, Eng.

* * * *

Cheaper Power Through Modern Equipment

THE editorial in the Sept. 11 issue on "Cheaper Power Through Modern Equipment," cites a good example of waste through poor distribution in a heating system. Waste through poor distribution is undoubtedly typical of many plants and applies to other lines as well as to heating systems.

The company using old machines will soon be faced with decreased production output. The use of up-to-date machines is the best remedy for decreased productivity. Of course the loss in efficiency, fractional though it is on a single unit of product, is multiplied through the years of active use to which the machine is put.

However, in the case of a power plant modernization that will effect a saving does not always necessitate buying new generating equipment. It is often the case where the high cost of production results entirely from conditions outside the power house. For instance, by bringing transmission or application equipment up to date, a substantial saving may readily be effected.

When a tool becomes old and inefficient to the extent that it is undependable, causing delays by breaking down, it is usually replaced. The cost of repairs is saved as well as labor when new and modern equipment is installed. The same line of reasoning should also be applied to items of equipment throughout the entire plant. For instance, turbines, engines and boilers may be modern and efficient, but the waste may lie in the motors, compressed-air lines or some similar part of the plant.

The necessity of making a periodic inspection and survey of all plant equipment cannot be too highly emphasized. Equipment of minor importance can ofttimes be found the cause of unnecessary waste.

In the case of the plant equipment it is not merely a question of getting work out quickly, but of producing work that will give the best results. Getting the most out of machines and equipment depends on obtaining the best machinery and equipment having the highest productive ability.

Of course old machines can be repaired, but in most cases they remain poor productive tools compared with machines of more recent design. The patching up of old machines instead of buying new ones saves an immediate outlay of ready cash, but the operation of obsolete machines eats into profits and materially increases the cost of manufacture.

Modernization of the entire plant equipment is a step in the right direction toward economy and efficiency in plant operation. Cheaper power is the natural result of equipment modernization. R. D. GUNNIS.

Philadelphia, Pa.

* * * *

Renewing Staybolts in Old Boilers

I WISH to take exception to some of the opinions expressed by R. A. Cultra in his article on "Renewing Staybolts in Old Boilers," in the Sept. 18 issue. Mr. Cultra has come forward with a view that is seldom taken as to the cause of staybolts breaking or fracturing, his opinion evidently being that staybolt failure is caused by stretching of the metal staybolt.

Personally, I do not think his view or theory is correct, as the failure of staybolts is most generally due to the unequal expansion and contraction of the inner and outer plates of the firebox. The failure generally occurs at the outer sheet, as this is the heavier of the two; also the heat from the firebox side must be taken into consideration.

If Mr. Cultra would examine the staybolts when they are removed from the boilers in question, no doubt he would find that the metal had become crystallized from the expansion and contraction during the long period of operation.

I cannot agree that it is a common occurrence for staybolts in internally fired boilers that have seen long periods of service to give trouble by failure. I have found few staybolts broken or fractured in boilers in stationary plants. Generally, where the boilers are old, the pressure has been reduced by the laws of the state; this in turn makes the staybolts less liable to failure.

The failure of a few staybolts in a boiler does not warrant the removal of all the staybolts, and there is no great danger unless the fractured staybolts are close together. However, I am not saying that broken or fractured staybolts should not be renewed; I am merely stating that a boiler that has had broken staybolts in it does not always constitute a menace. The cost of renewing all the staybolts in a boiler is high, and should not be undertaken merely because one breaks now and then. Look at the enormous expense that would be involved on our railroads, if everytime a staybolt breaks, they restaybolted the entire boiler instead of simply replacing the broken bolt.

I cannot agree that a tap of the hammer by any inspector would be proof enough that the staybolt is broken or fractured. It requires a well trained inspector to locate accurately broken staybolts with the hammer test. I have seen several inspectors assigned to the same boiler to give it a hammer test and no two of them had the same broken or cracked staybolts marked upon their charts. CHARLES W. CARTER, JR.

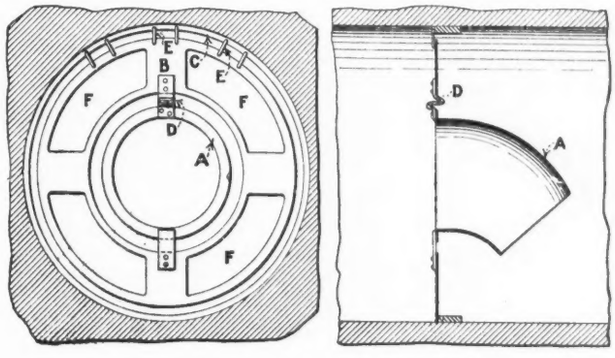
Binghamton, N. Y.

* * * *

Producing Vibrations in Flue Gases

RECENT researches have shown that the effects of vibration on draft are good if, instead of applying a steady draft, it is made to pulsate increased efficiency results. This condition can be produced by supplying an unsteady draft, but this is rather difficult to do. If pulsations can be produced in the flue gases, the same effect will be produced.

In the sketch *C* is an iron ring which is rigidly attached to the flue walls, *B* is an inner ring made of sheet iron fixed to the outer ring *C* by means of three flexible wire supports *E*. *A* is a cowl which is attached by means of the flexible scroll support *D* to *B*. These supports allow *A* to be free to vibrate; *B* is also free to vibrate on its supports *E*. The flue gases pass through the spaces *F* on the outer ring *B*, through the space between *B* and the cowl *A*, and through the cowl *A*. Both *B* and *A* are free to vibrate, and vigorous eddying is produced as the gas flow splits up through the various passages. This causes both *A* and *B* to vibrate, the effect of which is to make the air flow through the fuel bed pulsate and give the desired effect. The cowl *A* is made to direct the gases downward without imposing too much resistance to the flow of gases through the flue.



Arrangement of vibrating baffle

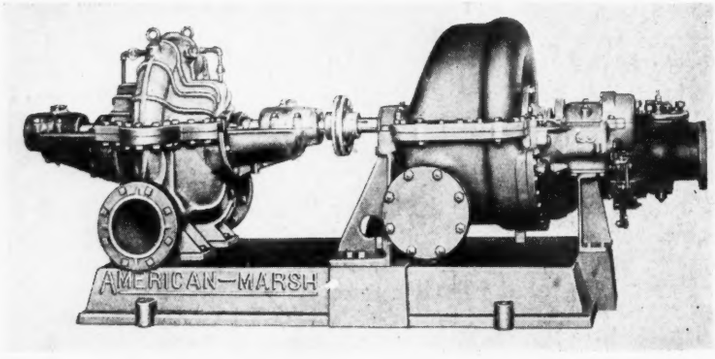
The arrangement illustrated was fixed in the flue of a Lancashire boiler and the results obtained were good. More uniform combustion was obtained over the fire bed, and the CO_2 was considerably improved, indicating that better combustion was secured. When fixed in the flue, it must not impose too much resistance. Flues are often of irregular sections, but so long as it can be rigidly fixed, space between *C* and the walls of the flue does not matter, provided the bulk of the flue gases flows through the openings in the plate and through the cowl and causes it to vibrate.

In the case described forced draft was used and the appliance was fixed in the flues close to the chimney, where it could be inspected easily. The improved results were, in my opinion, due to the pulsating air destroying the dynamic and chemical equilibrium in the fire bed. This equilibrium tends to act against efficiency, as it retards the speed of combustion. W. E. WARNER.

Brentford, England.

What's New in Plant Equipment

HOW THE MANUFACTURER CONTRIBUTES TO THE JOB OF GENERATING TRANSMITTING AND APPLYING THE POWER SERVICES



Type HBM pump with turbine drive

Improved Type HBM Centrifugal Pumps

A LINE of single-stage, general service pumps, known as type HBM, designed to give improved efficiencies has been recently added to the line of centrifugal pumps put out by the American Steam Pump Company, Battle Creek, Mich.

The casing or the volute of the pump is double-suction type split horizontally and with the suction and discharge nozzles cast integral with the lower half. The suction passages to the impellers are combined into a single opening, and all the passages in the casing are designed to give a uniform velocity to the water. The impeller is double-suction inclosed type and is hydraulically balanced. It is cast in one piece and machined all over to insure rotative balance. It is keyed to the shaft and held in place by bronze nuts formed on the sleeves which protect the shaft in the suction chamber and through the packing glands. The shaft is of open-hearth steel and of liberal diameter.

Renewable bronze wearing rings are provided on both impeller and casing and are designed with ample surface and small clearance to reduce the leakage to a minimum. The stuffing boxes are unusually deep and are fitted with a bronze lantern seal, split gland and swing bolts.

The shaft is carried in ring oiling sleeve bearings with outer and inner sleeves split horizontally. The bearings are supported on separate brackets bolted to the casing.

On all sizes 5-in. and larger, designed for heads of 150 ft. and over, a ball-thrust bearing is mounted on the outer end of the outboard bearing. For pumps smaller than 5-in. a thrust collar is used. The pumps are adaptable to practically any type of drive. For a direct drive a flexible disk type coupling is furnished.

Two-Cubic-Yard Crawler Shovel

THE addition of a 2-yd. capacity unit to its line of crawler cranes, shovels and draglines has been announced by the Link-Belt Company, Chicago, Ill. Heretofore the largest machine built by this company was a 1½-yd unit. The new K-55 machine may be used as a shovel, a dragline, a trench shovel, or with a 2-cu.yd. clamshell bucket. All attachments are interchangeable without removing or disturbing the mechanism of the machine proper. The power source is by gasoline engine, electric motor or Diesel engine. The machine in working condition is 12 ft. wide over all at the lower frame, with crawler treads 36 in. wide.

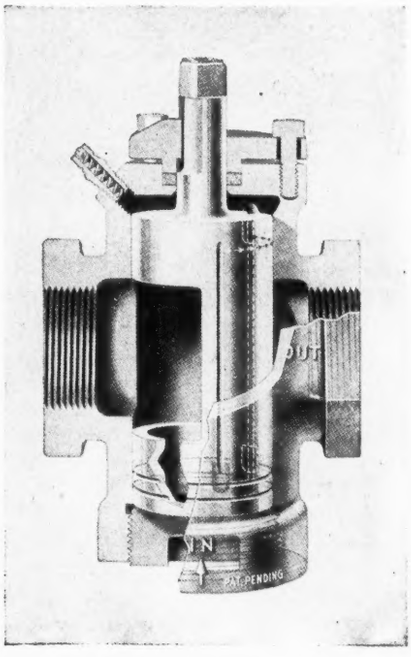
The main friction clutch is 42 in. in diameter; the wing and tread clutches, 30 in. Large drums with renewable cast-steel shells are used, having an air space between the clutch and brake services for rapid cooling. The 13½-in. center pin is adjustable from above and can be removed as a unit. When used as a shovel, the machine carries a 30-ft. boom and 18-ft. dipper stick, carrying a 2-cu.yd. manganese-steel dipper. The dragline boom is 59 ft. long for a 2-cu.yd. bucket, or 60 ft. long for a 1½-cu.yd. bucket.

Crawler shovel of two yards capacity

MacGregor Rotary Valves

A SELF-LUBRICATING valve with a positive seal, that turns freely and is adaptable to straightway or angle connections in liquid or gas lines in practically all types of industrial service, has been introduced by the MacGregor Valve Company, of

St. Louis, Mo. As shown in the accompanying illustration, the valve consists essentially of two members, the cylindrical rotor and the valve body. The rotor is a cylinder closed at the top and open at the bottom, with more than one-half of its wall cut away. The remaining wall area



Section of rotary valve

acts as a closure to the outlet port and has nearly an inch of lap to provide a seal. The rotor is free to move up and down and opens or closes on a quarter turn.

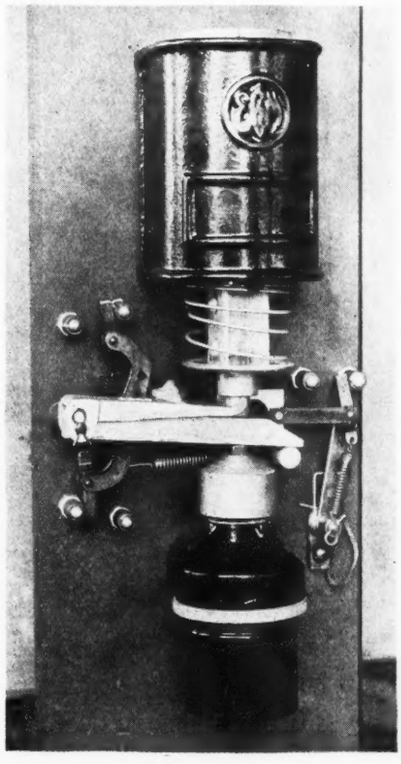
Between the valve head and the top of the rotor is the lubricant reservoir, which is filled with lubricating compound through a charging nipple when the valve is placed in service. The pressure of the injected lubricant tends to force the rotor downward to the depth of its travel, and the pressure in the pipe line forces the rotor upward, causing the lubricant to enter the vertical and horizontal grooves in the rotor face until they are completely packed and the two pressures are equalized.

As the valve is opened and closed, the lubricant in the rotor grooves wipes the inner wall of the valve body and establishes a thin sealing film between the bearing surfaces. The sealing action of the valve results from the maintenance of this lubricating film and the neutralization of the pipe line and lubricant pressures, as well as the action of the rotor side wall under pressure, which tends to flatten out and maintain the same contour as the inner wall of the valve body against which it is being forced by the line pressure.

These rotary valves are normally furnished in 150-lb. cast-iron or semi-steel, flanged or screwed, straightway, angle or multiple-port construction. Also, they can be furnished in corrosion-resisting metals, such as Duraloy, Illium, lead, aluminum and special alloys.

Relay Not Affected by Temperature

THE Type HG time relay illustrated, designed for use on any service requiring an electrical circuit to be made or broken after a definite interval, has been brought out by the Electric Controller & Manufacturing



Time relay without dashpots

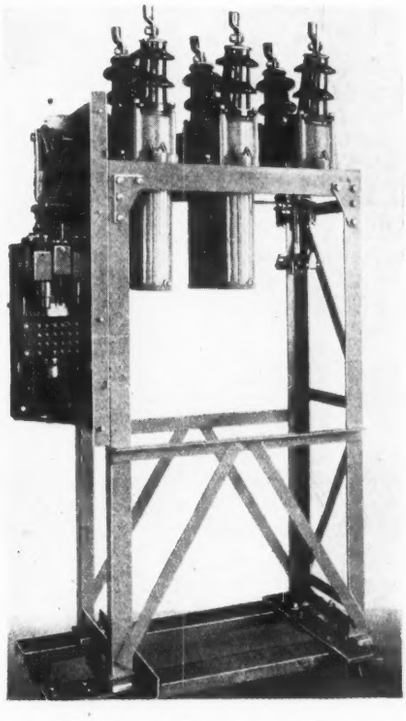
Company, Cleveland, Ohio. This relay operates on the hourglass principle with mercury escaping through an orifice in the bottom of a cup. The absence of dashpots makes it particularly well suited to conditions of widely varying room temperatures, as temperature changes do not affect its accuracy.

The coil may be arranged for 110- to 550-volt, 25- to 70-cycle alternating current or 115- to 550-volt direct current. Relays for alternating-current circuits have continuous-duty operating coils. Relays for direct-current use have intermittent duty coils which are protected for continuous duty where required by a protective resistor unit. Alternating-current relays are provided with a laminated plunger equipped with shading coil to give noiseless operation.

Outdoor Type FO-24 Oil Circuit Breaker

THE type FO-24 oil circuit breaker illustrated herewith has been brought out recently by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is designed specifically for outdoor service and is available in single-throw two- and three-pole construction, and in capacities of 400, 600 and 800 amp. for application to operating voltages of 15,000 or less. Motor, solenoid and manual-operated mechanisms, mounted directly on the frame or pole unit and inclosed in weatherproof housings, are applicable to all ampere capacities and pole sizes of the breaker.

The manual-operating mechanism



Circuit breaker mounted on structural-steel frame

is a complete, self-contained unit, having a cast semi-steel box, bolted directly to the end pole unit, which provides the necessary mounting surfaces and pivots for the levers and attachments of the mechanism. Various combinations of supplementary equipment must be used for special

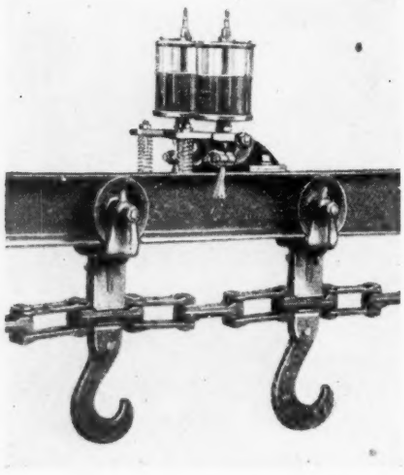
locations or automatic operation, including overload coils and relays and current transformers.

The electric-operating mechanisms are mounted directly on the frame and are inclosed by weatherproof sheet-metal housings. The type CF motor mechanism may be used for either alternating- or direct-current control, whereas the solenoid mechanism may be used for direct current only. Space is provided for all the tripping attachments and accessories in general use.

Among the important features which adapt the breaker to various classes of severe service, are the self-cleaning, high-pressure laminated brush contacts with heavy wedge-type arcing contacts; permanent submersion and opening of all contacts under a high head of oil; gravity break, assisted by heavy spring acceleration; elliptical, micarta-insulated sheet-steel tanks with all seams lap-welded and with ample space for air expansion; and shaft operation of breaker, with individual operating compartments and individual pole units, thus preventing oil and gas passage from one pole unit to another.

Automatic Conveyor Lubricator

LUBRICATION of conveyor wheels applied to various types of drying systems and industrial conveyors is provided by the use of an automatic



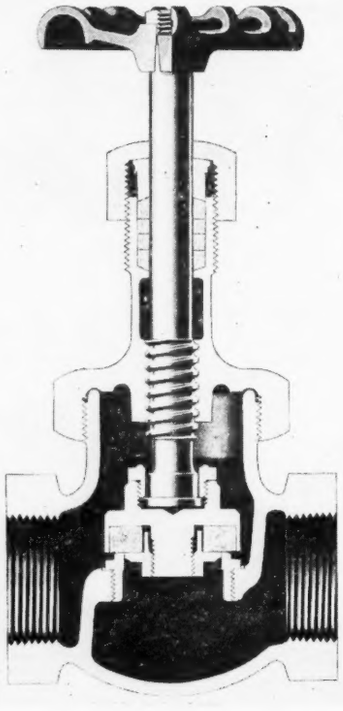
Conveyor lubricator in position

conveyor lubricator developed by the Saginaw Stamping & Tool Company, Saginaw, Mich. On conveyors over 5,000 ft. in length, two lubricators, one at each end of the conveyor, are recommended by the manufacturer.

The device consists of a sight-feed lubricator and a wiper brush which contacts with an oil spout on the conveyor wheel. The brush is kept in the proper position by means of a spring. Oil drops through an orifice in the sight-feed lubricator and enters a hollow bushing, directly over the brush. The oil-laden brush delivers oil to the bearing by the wiping contact against an oil spout. Ball- and roller-bearing wheels, as well as dustproof wheels, may be used.

New Line Bronze Valves for 250 Lb. Pressure

JENKINS BROS., New York, have recently introduced a new line of bronze valves fitted with renewable resilient disks for 250 lb. working



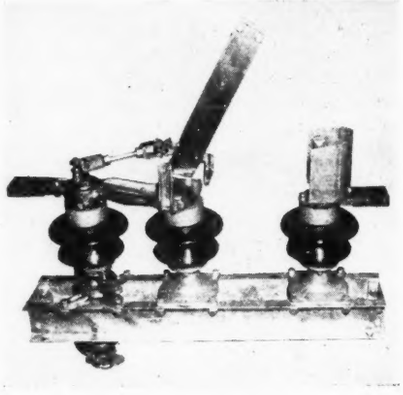
Cross-section of valve showing constructional details

pressures. The line comprises globe, angle, cross and horizontal and angle check patterns furnished screwed or flanged, in sizes ranging from ¼- to 2-in. The globe, angle and cross patterns are furnished with renewable seat rings. The bonnet screws over the body, and the bonnet seat joint is rounded.

Other features of the globe, angle and cross patterns include non-heat handwheel of malleable iron, deep stuffing box and manganese bronze spindle with large threads, all of which are in contact with the bonnet threads when the valve is closed.

Disconnecting Switch Has New Contact Principle

A HIGH-CAPACITY disconecting switch for group operation, in which the contact pressure is obtained independently from the movement of the blade was announced recently by the General Electric Company, Sche-



Switch in open position

nectady, N. Y. The switch, which is known at the type RP-2, is designed in ratings of 2,000, 3,000 and 4,000 amperes, and for voltages of 7,500, 15,000 and 25,000.

The new switch is of the conventional vertical-break type, the blade being swung between the open and closed positions by a linkage actuated by revolving insulator. An entirely new method of securing high-pressure contact is employed, however, which eliminates the heavy contact friction usually found in group-operated switches of the higher capacities, as well as the spring washers and flexible shunts commonly required at the hinge clip. The blade of the switch consists of two parallel copper bars between which there is a plunger with wedges at each end. When the plunger is moved forward by the action of the operating mechanism, the wedges force the blades outward against the contact blocks. In this way high pressure is developed between the contact surfaces, thereby insuring low resistance contact and forcing snow or ice formation from the contact area. Both wedging motion and blade movement are accomplished by a single turning of the operating handle.

The switch is mounted on a channel-iron base and is supported by heavy-duty pin-type insulators. All pins are of non-corrodible material, and ball bearings are used to support the rotating members. The contacts are of copper-alloy castings.

Combined Operation of
Steam and Hydro Systems

IN A paper at the summer meeting of the American Society of Mechanical Engineers at St. Paul, Aug. 27-30, James A. Colvin, superintendent of generation of the Northern States Power Company, presented some of the problems of operation that obtain on the interconnected system with which he is identified. The system extends over an irregular area approximately 250 miles east and west and 150 miles north and south. About 75 per cent of the load is concentrated in the small area of Minneapolis and St. Paul.

The heart of the transmission system consists of a 110-kv. loop which encircles the Twin Cities. The loop incloses an area of approximately 200 square miles, and to it are connected two major steam plants having a total capacity of 152,000 kw. and two 110-kv. lines interconnecting 64,000 kw. of hydro capacity from outside the loop. This hydro capacity is obtained from three plants in middle-western Wisconsin approximately 100 miles east of the loop. The foregoing steam and hydro plants, together with one other hydro plant of 21,400-kw. capacity, which feeds through one of the major substations over two 50-kv. lines approximately 40 miles long, constitute the major sources of power of this system. There are in addition some eighteen other smaller hydro and steam plants connected at various points on the system.

> Steam units are motored during periods of maximum hydro output, whereas hydro units are motored during periods of minimum hydro output. By venting the draft tubes, the power required to motor the hydro units is reduced about 50 per cent. It has been possible, by motoring idle generators, to maintain satisfactory voltage regulation on the system.

Voltage Regulation

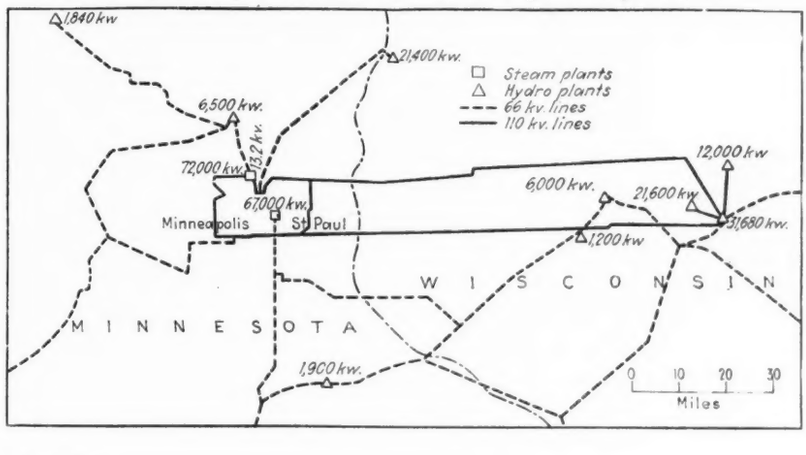
An analysis of system development was followed by comment on voltage regulation, which was considered the most important feature of a combined steam and hydro system, particularly when faced with extreme variations in power flow.

Referring to the figure, the two 110-kv. lines approximately 100 miles long may at times carry as much as 65,000 kw. to the largest load center. At other times, such as periods of low hydro output, even during normal load periods, the power transmitted over the lines is very little. Under night-load conditions the power supply may be actually reversed. To regulate the transmission voltage properly under these varying conditions, it has been found necessary to carry on the line approximately 75 per cent of the steam capacity normally required for power generation during the seasonal peak period. This is done to absorb reactive kva. and maintain the voltage within the range of regulation and compensation provided on distribution feeders.

During the excess hydro period it is necessary to generate a comparatively small amount of energy on the steam plants, and at times there is sufficient capacity at the hydro plants to carry the entire system load. Unless special provisions are made for keeping the turbine blading and wheels from overheating, the manufacturers of large turbine units generally recommend carrying a minimum load of not less than 10 per cent of the rated capacity of the unit. On 30,000-kw. units this would require between two and three tons of coal per hour, the greater part of which might be saved by arranging a proper supply of cooling steam to the turbine and carefully checking the turbine temperatures. With these precautions the turbine-generator units may be motored as synchronous condensers.

The possible number of hours that it would be desirable to motor the units, of course, would depend upon the ratio of hydro-plant capacity to the system load. A study of the load curves for the system indicates that it would be possible to motor normal-sized steam units for a total of 1,000 to 1,500 hours a year. If units are motored, it is possible to regulate the system voltage as well as to have "on the line" an immediate source of reserve capacity for protection against the failure of the transmission lines carrying energy developed at distant hydro plants, and at the same time save 2,000 to 3,000 tons of coal a year.

Primary transmission system of the Northern States Power Company, showing principal transmission lines and generating stations



How Water Is Conserved

Similarly, hydraulic units at subsidiary load centers are motored with gates closed and vented draft tubes, thereby reducing the amount of power required to carry the unit on the line by 50 per cent or more, and thus conserving water for generation of power during peak periods. Steam units are motored during periods of maximum hydro output, whereas hydro units are normally motored during periods of minimum hydro output. In this particular system the use of hydro and steam capacity, combined with certain motor-generator equipment used in the conversion of alternating current for direct-current systems, has provided sufficient synchronous condenser capacity to regulate satisfactorily the voltage of the system within the limits of the regulators and the distribution feeders, even though there are wide variations in the amount of load carried by the transmission lines. With the continued growth of substation loads and corresponding higher utilization of generating capacity, it is anticipated, however, that the installation of corrective equipment will be necessary.

Wide ranges of loading, seasonal variations of loading and low-load operation are the outstanding characteristics of the steam-plant operation in a combined steam and hydro system. Generally,

the comparatively low annual load factor at which steam plants are operated in such a system will not justify the installation of equipment producing high thermal efficiencies. More attention must be given to ruggedness of equipment, to its ability to withstand rapid starting and sudden load fluctuations and to provisions of equipment that is capable of carrying wide ranges of load with the highest over-all economy. Flexibility of operation is more important than high thermal economy.

Accurate Prediction of Hydro Output Impossible

No accurate prediction can be made of the hydro output that may be anticipated for any individual year; and this output from a group of hydro plants may exceed the minimum output by 50 per cent during an exceptionally good water year. This deviation from normal stream-flow results in a corresponding variation in requirements for energy generated at steam plants. Coal contracts must be based on minimum hydro conditions, or with sufficient tolerances to take care of the maximum anticipated steam production. To obtain favorable coal contracts, reasonable tolerances are permitted, but with the wide variations in hydro output the amount of coal contracted for to meet the minimum hydro conditions may exceed actual requirements by as much as 50 per cent. This makes desirable the establishment of substantial storage facilities to eliminate unreasonable tolerances in the coal contracts.

Changes of Scheduled Operation in Summer

During the summer months changes of scheduled operations will vary on extremely short notice following sudden rains, and make it essential for the steam supervisory organization to be kept in constant touch with the system operating conditions to establish economical operating schedules to meet the different requirements.

During the normal excess-water period it is necessary to carry sufficient capacity in service to protect against transmission-line failures and to regulate properly the voltage of the system. The operation of the boilers during this period was analyzed, and it was found that by applying the same careful study to this low-load operation as was applied to heavy-load conditions, startling economies could be obtained.

Not many years ago it was considered that a plant must be resigned to poor boiler efficiency when operating with banked fires or at low ratings. It was found, however, that efficiencies above 75 per cent could be maintained for long periods when operating with "live banked" boilers at about 25 to 30 per cent of rating. Efficiencies as high as 78 per cent have been maintained at a station over a period of four months, during which time the average rating of boiler capacity in service was approximately 25 per cent. Substantial savings in fuel resulted from this system of "live-bank" operation and discontinuance of the former procedure of carrying whatever small load there was on the station on one or two boilers and "dead" banking the rest of the boilers.

Probably the most decided advantage that a steam plant enjoys in a combined system is the period available for maintenance and overhaul of large units during the flood period in the spring. Two months can be definitely relied upon for this period. In emergencies, at almost any time of the year, the power supplied normally by a large steam unit may be taken care of for very short periods by pondage draw-downs, thus making it possible to take care of minor repairs of an emergency nature at once, before they develop to interfere seriously with service.

During the winter months, when the bulk of the power is carried on the steam plants, the hydro plants can take the swing of the system load, thus making it possible to establish extremely economical load factors on the steam plants at a time when circulating-water temperatures are low. This partly offsets the low thermal economy that accompanies low load and poor load factor at which the steam plants have had to operate during periods of excess hydro output.

Recent Publications

Suggestions for the Practice of Commercial Arbitration in the United States. Prepared by the American Arbitration Association. Published by the Oxford University Press; cloth; 9x6 in.; 247 pages. Price, $1.75.

THIS volume is a more comprehensive treatment of "Suggestions for the Guidance of Arbitration," previously issued by the Arbitration Association and intended for the use of the members of its National Panel of Arbitrators. It contains a complete description of the operation of this method of settling disputes and points out pitfalls to be avoided. Included in the volume is an appendix that contains a compilation and summary of the New York State and Federal laws relating to Arbitration. It is a book that should be of interest to both executive and lawyer.

Transformer Construction and Operation. By Emerson G. Reed. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York City, 1928. Cloth; 6x9 in.; 129 illustrations; 227 pages. Price, $3.

TRANSFORMERS within recent years have gone through many radical changes. The simple constructions of ten or fifteen years ago have given way to complicated machines capable of wide voltage adjustments, by automatic tap-changing devices. The methods of cooling have been changed and now units of very large capacity are self-cooling, where a few years ago only the small and medium sizes were of this type. These radical changes and others make a book like this one a desirable contribution to electrical literature at this time.

In this book the author gives a general treatment of the modern transformer. In the 25 chapters are those that deal with classification of transformers, rating of transformers, forms of construction, methods of cooling, heating and temperature control, oil and its conservation, connections, parallel operation, group operation and testing. The presentation begins with a short review of the main stages in the development of the transformer and then discusses in detail the construction and operation of the equipment.

Design is taken up only incidentally, and the use of mathematics has been avoided. Since most power systems today involve the use of transformers, the book should be of interest to engineers and practical electrical workers alike. It has grown out of a course of lessons prepared for use in the educational department of the Westinghouse Company and has been prepared in an easily read form.

Steam Tables — Properties of Saturated and Superheated Steam from 0.00886 to 3,300 lb., Absolute Pressure. Reprinted from *Superheat Engineering Data*, Seventh Edition, Revised. Published by The Superheater Company, 17 E. 42d St., New York City, 1928. Paper; 5x7 in. 18 pages of tables, and total heat-entropy chart insert. Furnished free on request.

ALTHOUGH good steam tables have been available for many years, there are still many engineers who make little or no use of this important tool of their profession. It is to be hoped that the availability without cost of this excellent little booklet, and its convenient form, will lead to a wider use of the steam tables. The tables are based on those in Marks and Davis' Handbook, but the vacuum, high pressure and superheat ranges have been extended to meet the demands of modern practice. Table I covers the properties of saturated steam from 32 deg. to 705 deg. (that is, to the critical point). This table is entered by the temperature. Table II is a similar table for various pressures. Table III, entered by pressure, gives the properties of saturated and superheated steam from 1 lb. to 3,300 lb. abs. for superheats up to 300 deg. F.

The total heat entropy diagram is large enough to use for practical work.

Events and Men in Power's Field

THE EDITORS WILL WELCOME THE CO-OPERATION OF READERS IN REPORTING INTERESTING HAPPENINGS, PERSONAL OR OTHERWISE

Bragdon, Lord & Nagle Company Affiliated with McGraw-Hill

Publishers of *Textile World* Join McGraw-Hill Group —Company also issues four other textile trade publications

AFFILIATION of the Bragdon, Lord & Nagle Company, publishers of *Textile World*, oldest business paper in its field, with the McGraw-Hill Publishing Company has been announced by James H. McGraw, president of the latter organization. The consolidation adds a new and important division to the McGraw-Hill organization and increases its business, industrial and engineering publications to twenty-three.

In addition to *Textile World*, which was established in 1868, three years after the Civil War, the merger includes the Consolidated Textile Catalog, *Textile Advance News*, Official American Textile Directory, the American Knitting Trade Directory, and a group of technical books devoted to the textile industry.

The Bragdon, Lord & Nagle organization will operate as a separate division of the McGraw-Hill Company and its management will continue in the hands of the men who built it. Henry G. Lord will continue as president, Frank L. Nagle as chairman of the board and H. O. Barnes as secretary. Joseph H. Bragdon will be vice-president and general manager. Mr. Lord and Mr. Bragdon become members of the board of directors of the McGraw-Hill Publishing Company, and Mr. Bragdon joins its executive committee.

Greater efficiency in news gathering, in editorial and advertising field representation and in mechanical production, all leading to a broader and more effective paper for readers and advertisers, were stressed as reasons for the consolidation in statements made by Mr. Lord and Mr. McGraw.

Mr. Lord said:

"Those of us who have guided the destinies of the *Textile World* and the other properties of the Bragdon, Lord & Nagle Company will continue, as members of the McGraw-Hill organization, the work which has been closest to us through long years of publishing experience. But now we have added strength in our work from the association of not only the McGraw-Hill Publishing Company itself but its president and other executives individually. Instead of standing alone in serving the great textile industry, we now have strong allies whose publishing experience covers the broad sweep of American business and industry.

"The textile industry, one of basic importance in the American and international industrial structure, will be distinctly the gainer from the arrangement by which the Bragdon, Lord & Nagle Company becomes a separate division of the McGraw-Hill Publishing Company. Together we will work shoulder to shoulder in a united effort to bring to the textile field a broader editorial and publishing service, a more intensive study of its problems and greater assistance in the solution of those problems."

Mr. McGraw said:

"Merger of the Bragdon, Lord & Nagle Company with the McGraw-Hill organization gives added strength to *Textile World*. Uninterrupted, it goes right on with the big job its founders chose for it in those early days immediately after the Civil War. Its personality is in nowise changed, and the men who built it still are its managers and its publishers. The merger simply means two strong organizations have joined hands to take *Textile World* farther forward and to make it even a greater paper than it has been.

"Through the consolidation we shall achieve economies and greater publishing efficiency in the gathering of news, in field representation along editorial, advertising and circulation lines and in mechanical production. The textile industry itself will profit through better editorial service and more extensive and intensive help in distribution and advertising problems."

Affiliation of the Bragdon, Lord & Nagle Company with the McGraw-Hill organization marks the second large-scale development to be effected by the latter company within three months. On June 29, Mr. McGraw announced a merger with the A. W. Shaw Company of Chicago which, as a division of the McGraw-Hill Company, is the publisher of the *Magazine of Business*, devoted to the general executive interests of all business, and of *System*.

The McGraw-Hill publications cover the fields of power, metal mining, coal, the electrical industry, food manufacture, industrial management, electric railway and bus transportation, machine tools, civil engineering and heavy construction, radio, chemical engineering and the broad sweep of business. The *Textile World* covers the major branches of its field—cotton, wool, silk, rayon, and other fibers; the knitting industry, and bleaching, dyeing and finishing.

Boiler Code Committee Advocates Jacketed Vessel Research

The A.S.M.E. Boiler Code Committee has recently recommended to the society's Main Research Committee that an investigation be made into the collapsing strength of jacketed vessels, digesters, enameled tanks, vacuum stills and similar vessels. It would be the purpose of such a research to formulate reliable design data, which are at present lacking.

There seems to be no general agreement among engineers on the proper formulas to be used for such designs. A number of tank fabricators estimate that a cylindrical shell will withstand externally only about 40 per cent of the pressure it will stand internally. It is realized, however, that this estimate is far from correct and altogether too approximate, as such a percentage would naturally vary with changes in diameter of the shell.

The problem has been stated by the Boiler Code Committee as follows:

1. Computation of strength of inner and outer shells of a jacketed cylinder with staybolts between shells;
2. Computation of strength of inner shell of jacketed cylinder when there are no staybolts;
3. Computation of strength of cylindrical structures similar to Scotch boiler furnaces for same general construction as stated in items 1 and 2.

It is realized that extensive experimental work may be required to obtain such information but the Main Research Committee feels that industry will be willing to support an investigation if it has a real need for the information.

Should an inquiry directed toward interested manufacturers justify it, a Special Research Committee of individuals will be organized from the interested concerns to head up the problem.

Swedish Hydro-Electric Power on Increase

The total production of hydro-electric power in Sweden for 1927 was 4,350,000,000 kw.-hr., which shows that the steady increase of the past few years continued during 1927.

The government-owned power plant at Norrforsen (North Sweden), which started production in the fall of 1926, contributed an increase of 82,000,000

kw.-hr. At the Central Group of the government-owned power plants (the Aelvkarleby, Goeta River, Motala and Vaesterass works), the increase amounted to 80,000,000 kilowatt hours.

Sydsvenska Kraftaktiebolaget (a private combine controlling the production of power in the extreme south of Sweden) produced 335,000,000 kw.-hr., compared with 285,000,000 in 1926. Yngeredsfors Kraftaktiebolag produced 56,000,000 kw.-hr., compared with 46,000,000, and the Gullspaang-Oerebro combine 114,000,000 kw.-hr., compared with 87,000,000.

The town of Stockholm increased its production by 15,000,000 kw.-hr., and a considerable increase is noted at the power stations owned by the large industries in Central Sweden. For 1928 no such big increases as in 1927 are expected, owing to the labor disputes, which have reduced the power requirements of several industries. Lower water levels are also expected than in 1927. The total water power exploited in the country at the beginning of the year was 1,475,000 hp. The increase during 1927 was only 30,000 hp.

This year the Hammarforsen power station (27,000 hp.) has been completed, the Kraangfors power station (17,000 hp.) is expected to start in a few months, and an extension of 18,000 hp. will be completed this year at the big Parjus power station in northernmost Sweden. The Munkfors station on the Klar River (Vaermland) and the Ianforsen station on the Dal River will not be ready to start until 1930.

Sydsvenska Kraftaktiebolaget has begun the construction of a 40,000-hp. plant at Karseforsen on the Lagan River, and plans have been prepared for the exploitation of the Avesta-Storfors Rapids on the Dal River, and the Askesta and Hoeljebro Rapids, owned by Bervik och Ala Aktiebolag, on the River Ljusnan.

The rapidity of the development of power production in the Central Swedish industrial district (Bergslagen and the neighboring regions) has been particularly remarkable, resulting in an increase of power production of 59 per cent in five years, and further considerable expansions are expected.

World Power Fuel Conference Opens in London

The World Power Fuel Conference was opened in London on Sept. 24 by the Marquis of Reading. A large gathering of representatives from all parts of the world was present, engineers from 54 countries being in attendance. The derivation of power from fuel of all kinds and for all purposes is being discussed in the 150 technical papers to be presented before the Conference, which closes Oct. 6.

One of the main topics of discussion will be low versus high-temperature carbonization of fuel. Both schools of thought are well represented. The question of pulverized-coal fuel in marine installations is also to receive considerable attention, particularly in view of several recent installations in British ships.

Internal-combustion engines have also received their share of attention, outstanding in this division being a paper by P. Yanouschevsky, a Russian delegate, describing experiments with Diesel engine-driven locomotives on Russian railways. According to this engineer the internal-combustion type of locomotive showed itself superior to the conventional steam locomotive in hauling power, speed and economy.

E. J. Mehren to Edit *Magazine of Business*

EDWARD J. MEHREN, vice-president and editorial director of the McGraw-Hill Publishing Company, has been appointed editor of the *Magazine of Business*, which recently came under McGraw-Hill control through the consolidation of that organization and the A. W. Shaw Company, of Chicago.

The *Magazine of Business* is published for the leaders in every branch

E. J. Mehren

of American business and treats of those major developments that affect business in general. It, therefore, has a strong appeal to the policy-forming executives in banking and finance, manufacturing and production, sales and distribution, and in the servicing fields, such as transportation, communication and electric light and power.

The editorship of such a paper required someone with a broad experience in business, a thorough knowledge of editorial and publishing practice and an acquaintanceship with all the editorial resources of the McGraw-Hill organization. It is for these reasons that Mr. Mehren, who has been with the McGraw-Hill organization for 21 years, was selected for the editorship.

Mr. Mehren began his publishing career as an associate editor on *Engineering Record*. Subsequently, he became editor of *Engineering Record* and of *Engineering News-Record*. For the last five years he has been vice-president and editorial director of the McGraw-Hill Publishing Company, in charge of the editorial activities of the organization. This position he will retain, while taking up his new duties.

Duquesne Light to Have New 60,000-Kw. Power Station

The Byllesby Engineering & Management Corporation announces authorization has been made for the construction of a 60,000-kw. capacity steam-electric generating plant in Pittsburgh, for the Duquesne Light Company, one of the Standard Gas & Electric Company group of utilities. The cost for the initial installation of this new station will be approximately $9,000,000, and it will be located adjacent to the Duquesne Light Company's switchhouse and south of the present power station, on Brunot Island.

The power-house building will be large enough to house two 60,000-kw. turbine-generators and six boilers, but at present only one 60,000-kw. unit and three boilers are to be installed, provision being made for future extension to the station.

The main building will consist of an electrical gallery and offices, a turbine room with spaces above the roof trusses for station auxiliary electrical equipment, and a boiler room. A circulating water pump and screenhouse will be located north of the present switchhouse on the bank of the Ohio River. The building will be of brick, tile and concrete construction with steel frame supported on concrete piling.

One coal tower having a capacity of 200 tons per hour will be installed for the purpose of unloading barges from the main channel of the Ohio River. The coal-tower structure will contain a receiving hopper feeding a 200-ton per hour crusher, the crusher discharging into an inclined elevated belt conveyor which will run from the coal unloading tower to a point approximately 75 ft. northeast of the present switchhouse.

Pulverized Coal Firing Favored by British Shipping Concerns

A vital development in marine engineering is indicated by the placing with the Blythswood Shipbuilding Company (Limited), Scotstoun, Glasgow, by the Berwindmoor Steamship Company (Limited), Liverpool, of an order for a cargo-carrying steamer of 8,000 tons dead weight, in which pulverized coal will be used as fuel for the raising of steam. This is the first vessel specially designed and built for the use of pulverized coal as fuel.

The vessel will be a coal and iron ore carrier, about 400 ft. in length, 52 ft. in breadth, 32 ft. in depth, and of 8,000 tons dead weight. The designed speed is 10½ to 11 knots loaded.

The "raw" coal will be carried in ordinary bunkers, and it will be pulverized on board by a special plant, which will require comparatively little space, but will rise through the decks to a fair height. After being reduced to a fine powder, the coal will pass into a hermetically sealed storage chamber, from which it will be forced into the

furnaces through nozzles, in a way similar to that used for oil fuel.

It is believed that the use of pulverized coal as fuel for steam-raising will have a number of advantages. The stoking will be as simple as that of oil, and there will be no open furnace doors, no stokers such as those employed on board ordinary coal-fired vessels; and the stokehold will always be clean and cool.

Other Installation Successful

News of this order follows closely the successful termination of a 13,000-mile trial run of a powdered-coal-fired freighter, S. S. "Stuartstar" of the Blue Star line. This vessel was operated on regular schedule over the round trip from London to Buenos Aires with entire absence of trouble, although the pulverized-fuel installation had been made just before sailing. As the result of the successful experiment with powdered fuel, the Blue Star line management is projecting the use of this type of firing on all of its ships plying between Great Britain and South American ports. An improvement in boiler efficiency of 18 to 20 per cent is claimed over hand firing.

The boat was equipped with Resulutor pulverizers and burners by the Clarke Chapman & Company, Gates Head-On-Tyne, England. The pulverizers were equipped with air classifiers which assured delivery of uniform fine coal that would pass through a 300-mesh screen.

Rotor-Ship Company Dissolved

The organization formed in Germany to exploit the use of the Flettner rotor device for use on ships, has been dissolved. The first rotor-driven ship, originally called the "Buckau," but renamed the "Baden-Baden," has been sold to the Cape Navigation Corporation in the United States. The corporation will use the ship without rotors.

Utility Merger in New York City Brings Rate Reduction

Matthew S. Sloan, president of the New York Edison Company, the Brooklyn Edison Company, the United Electric Light & Power Company, and the New York & Queens Electric Light & Power Company, has announced that new and lower rate schedules to be effective Oct. 1, have been filed with the Public Service Commission. The elimination of a surcharge based on the fluctuating price of coal, is the principal cause of the reduction, he said. The net effect of these rate changes, he said, will be to reduce the electric bills paid by customers about $4,500,000 in the next twelve months.

The so-called coal charge will be eliminated from the bills of all household or domestic customers and retail stores, the reduction thus affecting about 99 per cent of the total customers. It will be reduced in the case of other commercial establishments and of wholesale users of power for manufacturing also.

The coal charge was first made, according to Mr. Sloan, when the price of coal became excessive. Electric companies, large purchasers of coal, found themselves compelled to pay widely varying prices for it, and rather than increase their established rates, worked out schedules of additional charges based on the changing prices of coal. Recent experience indicates that the price of coal used in making electricity is tending to stabilize, and that fact has been taken into consideration in the new rate schedules filed with the Public Service Commission.

Coming Conventions

American Institute of Electrical Engineers, annual winter convention, New York City, Jan. 28-Feb. 1; annual summer convention, Swampscott, Mass., June 24-28; F. L. Hutchinson, secretary, 33 West 39th St., New York City.

American Institute of Refrigeration, at Washington, May, 1929. Louis Baron, secretary, 203 West 13th St., New York City.

American Society of Refrigerating Engineers, at New York City, Dec. 2-6, 1928. David S. Fiske, secretary, 37 West 39th St., New York City.

American Refractories Institute, fall meeting, New York City, Oct. 24, D. A. Texter, secretary, 2202 Oliver Building, Pittsburgh, Pa.

American Welding Society, fall meeting at Philadelphia, Pa., Oct. 8-12; M. M. Kelly, secretary, 29 West 39th St., New York City.

Master Boiler Makers Association, at Atlanta, Ga., May 21-24. H. D. Vought, secretary, 26 Cortlandt St., New York City.

Midwest Power Conference and Exhibition, at Chicago, Feb. 12-16; G. E. Pfisterer, secretary, 53 West Jackson Blvd., Chicago.

National Association Practical Refrigerating Engineers, annual convention at Louisville, Kentucky, Nov. 20-23; E. H. Fox, secretary, 5707 West Lake St., Chicago, Ill.

National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York City, Dec. 3-8. Address inquiries to the International Exposition Company, Grand Central Palace, New York City.

Stoker Manufacturers Association, fall meeting at Greenbrier Hotel, White Sulphur Springs, W. Va., Oct. 22-24.

Second Bituminous Coal Conference will be held at Pittsburgh, Nov. 19-22.

Internal Combustion Group Visits Bureau of Standards

A group of 23 members of the Society for the Development of Internal Combustion Power, which is interested in every branch of research and standardization which touches on the use of petroleum as a fuel, recently visited the laboratories of the U. S. Bureau of Standards at Washington, D. C. The group, which was in charge of the secretary of the society, Harry Botsford, of Titusville, Pa., was told briefly of the Bureau's work in this field by Dr. George K. Burgess, director, and Ray M. Hudson, assistant director in charge of commercial standards. The visitors then inspected the automotive laboratories as well as portions of the work in metallurgy and mechanics.

Niagara Power Company Among Many Receiving Licenses From Federal Commission

Most important of the licenses granted to power companies for hydraulic development by the Federal Power Commission at its Sept. 24, meeting, was a temporary permit issued to the Niagara Power Company to utilize the remaining 275 sec.-ft. of treaty water at Niagara Falls. This water is the last of the original 20,000 sec.-ft. made available to American users by the treaty of May 13, 1910, with Great Britain.

This water was formerly authorized for use down Eighteen Mile Creek, near Lockport, N. Y., under license of the Hydro-Electric Race Company and others, which license was surrendered in order to permit the use of the water more efficiently at the Falls by the Niagara Falls Power Company.

The Niagara Falls Power Company made application for an amendment of its license to include the 275 cu.ft. of water per second, but it was stated by the commission that the proposed amendment cannot be acted upon for some time on account of the impossibility of submitting a statement of preliminary costs to the commission.

The commission's auditor is now going over the accounts of the Niagara Falls Power Company, but cannot complete the audit for at least two months. The 5,000 hp. which can be generated at Niagara Falls from this water, is declared to be urgently needed by industries in the vicinity, pending completion of another steam unit at Buffalo.

At the same meeting the commission authorized the issuance of a preliminary permit to the Cascade Power Company, of Seattle, covering a project on May Creek. It is proposed to store water in Lake Isabel. It is planned to install 20,000 hp.

In authorizing a license for the Porto Rico Railway, Light & Power Company, the commission limited it to the lower unit of the project, where it is planned to install 7,000 hp. This portion of the development provides for the construction of dams and appurtenant works on five Porto Rican streams.

A license was authorized in favor of Frank I. Reed, of Anchorage, Alaska, covering a proposed development on Eklutna River. Eklutna Lake is to be used for storage. It is proposed to install 26,000 hp. and transmit the power 26 miles to Anchorage.

The preliminary permit of the Oregon-California Hydroelectric Company was cancelled on the ground that it had failed to reimburse the Geological Survey for expenditures amounting $873.38 for stream gaging.

An existing license of the Western States Gas & Electric Company was amended so as to exclude from it those

parts of its transmission system located south and west of the interconnection with the El Dorado plant. The Pacific Gas & Electric Company has applied for a license to cover that part of the transmission line.

The Arkansas Power & Light Company was authorized to extend for four years the period for constructing the Carpenter Dam in the Ouachita River. On the recommendation of the Chief of Engineers the license also was amended so as to require further studies of the proposed Blakely Dam.

The commission approved the transfer from the El Dorado Power Company to the Western States Gas & Electric Company of project 184 on the South Fork of the American River, and the transfer from the Western States Gas & Electric Company to the Pacific Gas & Electric Company of other projects on that stream and on Canyon Creek. The transfer of a transmission line in San Benito County, Calif., from the Coast Valleys Gas & Electric Company to the Pacific Gas & Electric Company also was approved. The Grangeville Electric Light & Power Company was authorized to transfer a project on the South Fork of Clearwater Creek in Idaho to the Inland Power & Light Company. Another transfer approved was that of the Enterprise Electric Light Company to the Inland Light & Power Company of project on the East Fork of the Wallowa River.

The City of Sand Point, Idaho, has applied to the Commission for a license covering the first unit of a project on Priest River. It is proposed to create 100,000 acre-feet of additional storage in Priest Lake, and to install two 700-hp. units.

Business Notes

THE STANDARD WIRE & TUBE COMPANY is the name adopted by the new organization formed by the consolidation of the American Tube & Pipe Bending Company, of Niles, Ohio, and the Ridge Stamping & Fabricating Company, of Mineral Ridge, Ohio. The new company will operate as complete fabricators of wire, pipe, and tube products, with general offices and works at Mineral Ridge, Ohio (Youngstown District).

THE BASSICK MANUFACTURING COMPANY, 2650 No. Crawford Ave., Chicago, Ill., announces that its name has been changed to the Alemite Manufacturing Corporation. There will be no change in the address of the corporation.

THE LINDE AIR PRODUCTS COMPANY, New York City, announces the opening of a new plant, at 125 Settlement St., Akron, Ohio. This plant started producing oxygen on Sept. 11 and will supply the near-by demand for the gas, used in welding and cutting by the oxyacetylene process. The addition of the Akron unit to the Linde chain brings the total up to 54. The plant will be operated under the direction of A. Deagon, superintendent.

STARKWEATHER & BROADHURST, INC., Boston, Mass., announce with regret the retirement of F. S. Broadhurst from the corporation.

N. A. HELMER announces the organization of the Helmer Company, Woolworth Building, New York City, to make investigations of plants, technical processes, chemical and mechanical, to devise improvements in process work and equipment and to supervise the installation and operation of equipment. Mr. Helmer was formerly in the employ of Ford, Bacon & Davis, Inc., of New York City.

M. H. DETRICK COMPANY, Chicago, Ill., announces that it is now represented in Cincinnati, Ohio, by the Ash Engineering Company, G. C. Parr, 1021 Chamber of Commerce Building.

THE HARRISBURG FOUNDRY AND MACHINE WORKS announces that its receivership has been terminated and that the company has been reorganized under the name of the Harrisburg Foundry & Machine Company, Inc., C. W. Lynch, president. The organization will continue the manufacture of Harrisburg engines of various types, as well as conducting a general foundry and machine work business, the location of the plant remaining the same.

THE IDEAL COMMUTATOR DRESSER COMPANY, Syracuse, Ill., announces that its interests are being handled in New England by Albert E. Mace Company, Inc., 93 Heath St., Boston, Mass.

Personals

ARTHUR S. HAWKS has resigned as chief engineer of Busch-Sulzer Bros. Diesel Engine Co. He had been with this company for the past thirteen years.

THOMAS J. SULLIVAN announces the opening of the office of "Sullivan & Hamilton," consulting engineers, industrial heat and power specialists, 551 Fifth Ave., New York City.

L. E. GRIFFIN has recently been appointed sales manager of the Riley Stoker Corporation. Prior to this Mr. Griffith had been district manager of the New York office of the company.

MORTIMER E. COOLEY, past-president of the American Engineering Council and head of the college of engineering and architecture at the University of Michigan, has retired from his position with the university.

J. R. FOLSE, of Northwestern University, has been appointed curator of the division of prime movers, Rosenwald Industrial Museum, of Chicago.

WILLIAM D. BLISS, formerly professor of mechanical engineering at Marquette University, Milwaukee, Wis., has joined the faculty of the Agricultural and Mechanical College of Texas, in the mechanical engineering department.

F. R. FISHBACK, president of the Electric Controller & Manufacturing Company, Cleveland, Ohio, has been elected vice-president in charge of the Apparatus Division of the National Electrical Manufacturers Association.

D. H. W. FELCH has been made plant engineer of the Perth Amboy plant of the Standard Underground Cable Company.

R. L. RHOADS has accepted the position as dean of engineering in the University of Wyoming, Laramie.

GEORGE A. COOPER, formerly superintendent of materials of the Monongahela West Penn Public Service Company, Fairmont, W. Va., has been appointed an assistant chief business specialist in

Fuel Prices

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	Price per Ton
Navy Standard...	New York.....	$2.30@$2.50
Kanawha.....	Columbus.....	1.25@ 1.60
Smokeless.....	Cincinnati.....	1.75@ 2.25
Smokeless.....	Chicago.....	1.75@ 2.25
S. E. Kentucky...	Chicago.....	1.50@ 1.75
Steam.....	Pittsburgh.....	1.40@ 1.90
Gas Slack.....	Pittsburgh.....	1.15@ 1.25
Big Seam.....	Birmingham....	1.25@ 1.50
Anthracite (Gross Tons)		
Buckwheat.....	New York.....	$3.00
Barley.....	New York.....	1.35@ 1.75

FUEL OIL

New York—Sept. 27, f.o.b. Bayonne, N. J., 28@34 deg., Baumé, industrial use, tank-car lots, 4¾c. per gal.; 36@40 deg., furnace, tank-car lots, 7c. per gal.

St. Louis—Sept. 19, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.346 per bbl. or 42 gal.; 26@28 deg., $1.396 per bbl.; 28@30 deg., $1.446 per bbl.; 30@32 deg., $1.496 per bbl.; 32@36 deg., gas oil, 4.151c. per gal.; 38@40 deg., 4.918c. per gal.

Pittsburgh—Sept. 18, f.o.b. local refinery, 30@34 deg., fuel oil, 5c. per gal.; 36@40 deg., 5¼c. per gal.

Philadelphia—Sept. 17, 26@30 deg., $1.89@$1.96 per bbl. or 42 gal.; 13@19 deg., $0.95@$1.02 per bbl.; 22 plus. $1.43@$1.50 per bbl.; 27@30 deg., $2.00@$2.07 per bbl.

Cincinnati—Sept. 24, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 5c. per gal.; 26@30 deg., 5¼c. per gal.; 30@32 deg., 5.95c. per gal.

Chicago—Sept. 15, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl. or 42 gal.; 22@26 deg., 57½@ 60c. per bbl.; 26@30 deg., 75c. per bbl.; 30@32 deg., 95c. per bbl.

Boston—Sept. 17, tank-car lots, f.o.b. 12@14 deg. Baumé, 4.425c. per gal.; 28@32 deg., 5.62c. per gal.

Dallas—Sept. 24, f.o.b. local refinery, 26@30 deg., $1.15 per bbl. or 42 gallons.

the Division of Simplified Practice of the Bureau of Standards, United States Department of Commerce. Mr. Cooper has had considerable experience in the actual application of simplified practice within a company, inasmuch as his concern reduced its financial investment in inventory by 33 per cent and eliminated 16 per cent of the items carried in stock through simplification.

Trade Catalogs

CENTRIFUGAL PUMPS—In a 32-page illustrated bulletin, issued as No. 273, the Byron-Jackson Pump Company, Berkeley, Calif., give exhaustive treatment to the subject of high-pressure multi-stage centrifugal pumps. The illustrations are numerous and many of them show the company's product both in the assembled and disassembled form, so that the working principles of the pumps may easily be understood. A considerable number of typical installation views are also included in this new bulletin.

EXHAUST GAS STEAM GENERATOR—In an eight-page bulletin B-3 the Davis Engineering Company, 90 West St., New York City, describes equipment for recovering a portion of the waste heat in the exhaust of oil-engine power plants. The apparatus, known as the "Paracoil" generator, may be used for the production of process steam, heating steam, hot water, and for many other purposes. Back pressures are actually lowered by the action of the generator, it is claimed.

ABRASIVES AND REFRACTORIES — The Norton Company, of Worcester, Mass., has issued an illustrated booklet of 30 pages which describes the character and uses of Norton products as shown in Norton Hall, Worcester. The booklet includes sections on abrasives, grinding wheels and refractories.

SYNCHRONOUS MOTORS—The General Electric Company, Schenectady, N. Y., has issued a 4-page bulletin, No. GEA-1052, describing a line of general-purpose synchronous motors of two- and three-phase design, ranging in output from 75 to 200 hp. Voltage ratings are for 220 up to 2,200 volts. Salient features of these motors are illustrated and described, and several paragraphs and an illustration are devoted to the control equipment.

RESISTANCE THERMOMETERS—A recent 28-page catalog, No. 80, of the Leeds & Northrup Company, 4901 Stenton Ave., Philadelphia, Pa., describes the L. & N. resistance thermometers for controlling, recording and indicating temperatures. In this bulletin accuracy and reliability, advantages of the Wheatstone-bridge method, selection of equipment and other factors are considered. There is also shown a number of typical installations in industrial and power plants.

GRAPHIC INSTRUMENTS—A four-page bulletin No. 828, issued by the Esterline-Angus Company, Indianapolis, Ind., describes and illustrates the methods by which this company's product is designed, manufactured and tested. In this bulletin a statement is made of the company's invitation to customers to send their operating men to the factory for a close-up view of the processes of manufacturing graphic instruments.

New Plant Construction

COMPILED BY THE MCGRAW-HILL BUSINESS NEWS DEPARTMENT, WHICH IS PREPARED TO FURNISH A MORE COMPLETE DAILY SERVICE TO THOSE WHO WISH IT

Calif., Los Angeles—Los Angeles County, awarded contract for the construction of an 11 story hospital to Weymouth Crowell Co., 2104 East 15th St. Estimated cost $8,000,000. Steam heating and ventilation systems, elevators, etc. will be installed.

Calif., Pittsburgh—Pacific Gas & Electric Co., 245 Market St., San Francisco, is having preliminary plans prepared for the construction of a sub-station here. Estimated cost $100,000. Private plans.

Calif., San Diego — J. E. Collumb, c/o Walker & Eisen, Western Pacific Bldg., Los Angeles, is having preliminary plans prepared for the construction of a 12 story hotel and apartment building here. Estimated cost $1,500,000.

Calif., Suisun — City plans an election soon to vote $20,000 bonds for waterworks improvements including booster pumping plant.

Conn., Buckland — E. E. Hillard Co. awarded contract for the construction of a power house to Manchester Construction Co., 875 Main St., South Manchester.

Ga., Atlanta — Thrower Realty Co., Thrower Bldg., is having plans prepared for an 11 story hotel including steam heating system, etc. at Mitchell and Forsyth Sts. Estimated cost $500,000. Silas D. Frowbridge, Forsyth Bldg., is architect.

Ga., Augusta — Savannah River Electric Co., subsidiary of Southwestern Power & Light Co., 120 Broadway, New York, N. Y., plans the construction of a hydro-electric plant on the Savannah River near here. Estimated cost approximately $20,000,000. Work will be done with own forces.

Ill., Chicago—Schmidt, Garden & Erickson, 104 South Michigan Ave., Archts., will receive bids until Oct. 5, for a 19 story apartment building including elevators, etc. at 65 West Walton Pl. for Huguelet Bros., 908 Huguelet Pl. Estimated cost $1,500,000.

Ill., Chicago—Syndicate, c/o D. Saul Klafter, 64 West Randolph St., Archt., is having plans prepared for a 15 story apartment building at 826-32 Blackstone Ave. Estimated cost $2,000,000.

Ill., Chicago—Syndicate, c/o B. Leo Steif & Co., 307 North Michigan Ave., Archts., will soon award contract for a 20 story apartment building at 4940 East End Ave. Estimated cost $1,000,000.

Ind., Anderson — Bd. of Public Works, will receive bids until Oct. 8, for the construction of a sewage treatment plant including pumping station. Estimated cost $310,000.

Ia., Sioux City—Cudahy Packing Co., A. F. Mills, Supt., awarded contract for the construction of a 54 x 146 ft. cold storage plant, to E. A. Whitney, 619 5th St. Estimated cost $200,000.

La., New Orleans — American Bank & Trust Co., Carondelet St., awarded contract for a 21 story bank and office building at Carondelet St. to G. J. Glover Co., Whitney Bldg. Estimated cost $1,409,975. Steam heating and ventilation systems, boilers, pumps, elevators, etc. will be installed.

Mass., Boston — Osler Medical Building Trust, A. P. Pearce, Jr., 15 State St., is having plans prepared for an 8 story office building at Bay State Rd. and Sherborn St. Estimated cost $1,000,000. Blackall, Clapp & Whittemore, 31 West St., Boston, are architects.

Mich., Ann Arbor—Ann Arbor Savings Bank, will soon award contract for the construction of a 10 story bank and office building at Main and Huron Sts. Estimated cost $1,000,000. Pond & Pond, Martin & Floyd, 189 North Michigan Ave., are architects.

Mich., Detroit — J. Lee Baker, 344 Penobscot Bldg., is having preliminary plans prepared for a 12 story apartment building including steam heating, ventilation and refrigeration systems, boilers, elevators, etc. at Six Mile Rd. and Stoepel St. Estimated cost $1,000,000. Private plans.

Mich., Detroit—City, J. W. Reid, Comr. of Public Works, will receive bids until Nov. 14, for sewage treatment plant, pumping station, switch house, etc. P. A. Fellows, City Hall, is engineer.

Mich., Eloise—Wayne County, City Service Bldg., awarded contract for a hospital on Michigan Ave. to Stibbard Construction Co., 3000 Grand River Ave., Detroit. Estimated cost $500,000. Steam heating, and ventilation system, boilers, elevators, etc. will be installed.

Mich., Grand Rapids — Pere Marquette R.R., Detroit, awarded contract for the construction of a cold storage plant on Ottawa St. here to Owen-Ames-Kimball, Pearl St. Estimated cost $250,000. H. A. Cassil, is chief engineer.

Minn., Duluth—City, G. P. Phillips, City Comr., City Hall, will receive bids until Oct. 15 for the construction of a vertical lift bridge to span the entry into Duluth harbor. Estimated cost $550,000. Sources of power to operate the bridge will be electricity, gasoline engine and storage battery.

Miss., Oxford—City awarded contract for the construction of a 42 x 72 ft. power plant to W. R. Ellis, Clarksdale. T. H. McElroy, mayor.

Mo., Fayette—City awarded contract for extensions and improvements to electric light plant including Diesel engine to Fairbanks-Morse Co., 1218 Liberty St. Estimated cost $60,200.

Mo., Osceola—West Missouri Power Co., Pleasant Hill, has made application for permit to construct a hydro-electric power plant and dam on the Osage River here including two 800 kw. generators to supply current to Ozark Utilities Co. and Missouri Public Service Co. Estimated cost $356,900.

Mo., St. Louis—H. J. Rush, et al, c/o Rush, Lee & Rush, 6038 Delmar Blvd., Archts., are having revised sketches made for a 15 story hotel at Delmar Blvd. and Des Peres Ave. Estimated cost $2,000,000.

Mo., St. Louis — Local Syndicate, c/o W. J. Abbott, 806 Chestnut St., will soon receive bids for the construction of a 25 story apartment building at Lindell and Euclid Sts. Estimated cost $2,000,000. J. L. Bowling and L. Shank, Arcade Bldg., are architects.

Neb., Harvard — City awarded general contract for the construction of a municipal electric light plant to Earl Ellis, West 12th St., Hastings. Estimated cost $32,284.

N. J., Newark—Public Service Electric & Gas Co., 80 Park Pl., will build an electric sub-station at 304-12 Norfolk St. Estimated cost $75,000. Work will be done by separate contracts.

N. Y., New York — Club Hotel Corp. of New York, H. Barth, Pres., 116 West 72nd St., plans the construction of a club and hotel building. Estimated cost $1,300,000. F. M. Andrews, c/o owner, is architect.

N. Y., New York—Consolidated Gas Co., 14th St. and Irving Pl., plans an 18 story addition to office building now nearing completion. Estimated cost $2,500,000. T. E. Murray, 55 Duane St., is architect.

N. Y., New York—G. L. Ohrstrom, 44 Wall St., awarded contract for a 30 story office building at Madison Ave. at 47th and 48th Sts. to G. A. Fuller Co., 949 Broadway. Estimated cost $2,000,000.

N. Y., New York—Two Hundred Seventy Broadway Co., R. E. Dowling, Pres., plans the construction of a 28 story office building at Broadway and Chambers St. Estimated cost $2,500,000. E. H. Faile & Co., 441 Lexington Ave., are architects.

N. Y., Rifton — Central Hudson Gas & Electric Corp., 50 Market St., Poughkeepsie, will build a dam here. Estimated cost $130,000. C. T. Main, 201 Devonshire St., Boston, Mass., is engineer. Work will be done by day labor.

O., Elyria—John Pekras, Prop. of Capitol Theatre, is having preliminary plans prepared for an 8 story hotel, theatre and stores building on Broad St. Estimated cost $1,000,000. R. H. Hinsdale, Erie Bldg., Cleveland, is architect.

Okla., Barnsdall — Barnsdall Oil Co., is having plans prepared for the construction of a new motor driven water plant on Bird Creek near here. Estimated cost $60,000. Private plans.

Okla., Porum—Porum Ice Co., is having preliminary plans prepared for the construction of a 10 ton raw water ice and cold storage plant. Estimated cost $25,000. Private plans.

Okla., Sapulpa — City is having preliminary plans prepared for the construction of a municipal electric light plant. Estimated cost $250,000. F. E. Lawrence, is engineer.

Okla., Tulsa—C. W. Bliss, Bliss Bldg., awarded contract for a 10 story hotel at Second and Boston Sts. to J. W. Van Horn, 526 South Kanosha St. Estimated cost $600,000. Steam heating, ventilation and refrigeration systems, boilers, pumps, elevators, etc. will be installed.

Pa., Philadelphia—Blackstone Hotel, c/o P. M. Julian, 917 15th St. N. W., Washington, D. C., Archt., awarded contract for a 22 story hotel at 13th and Locust Sts. to F. V. Warren Co., 1913 Arch St., Philadelphia. Estimated cost $2,000,000.

Pa., Philadelphia—One Thousand Twelve Spruce St. Corp., c/o Ritter & Shay, Packard Bldg., Archts., awarded contract for a 30 story apartment building at Spruce and Hicks Sts. to Murphy Quigley Co., 1512 Sansom St.

Pa., Philadelphia—Reading Co., will soon award contract for a 10 story commercial building at Noble, 13th, Broad and Callowhill Sts. Estimated cost $3,000,000. Terminal Warehouse Co., Delaware Ave. and Front St., lessee.

Pa., Philadelphia—St. Lukes & Children's Hospital, c/o A. W. Barnes, Perry Bldg., Archt., awarded contract for an 11 story hospital at 8th and Thompson Sts. to W. Steele & Co., 16th and Cherry Sts. Estimated cost $1,000,000.

S. C., Columbia—General Gas & Electric Corp., New York, N. Y., subsidiary of W. S. Barstow & Co. Inc., 50 Pine St., plans the construction of a 30,000 kw. unit to steam power plant at Parr Shoals, 40 mi. from here to increase the capacity to 72,500 kw. To be built by the construction department of the W. S. Barstow & Co., 50 Pine St., New York, Engrs.

Tex., Dallas — Titche-Goettinger Co., E. Titche, Pres., Main and Ervay Sts., awarded contract for an 8 story department store on Elm St. to Watson Co., Santa Fe Bldg. Estimated cost $1,000,000.

Tex., Edinburg — Pacific Fruit Express Co., is having plans prepared for the construction of 10,000 ton addition to ice plant. Private plans.

Wash., Seattle—T. H. Gowman, Gowman Hotel, is having preliminary plans prepared for a 20 story hotel at 5th and Stewart Sts. Estimated cost $1,000,000. Architect not selected.

Wis., Milwaukee—Northwestern Mutual Life Insurance Co., 210 East Wisconsin Ave., is having plans prepared for an 8 story office building on Mason St. Estimated cost $3,000,000. Holabird & Root, 333 North Michigan Ave., Chicago, Ill., are architects.

B. C., Vancouver—Syndicate, c/o McCarter & Nairne, 807 Northwest Bldg., awarded contract for the construction of a 14 story medical and dental office building and garage at Georgia and Hornby Sts. to Carter-Hallsaldinger Co. Ltd, 500 Beatty Bldg. Estimated cost $1,200,000.

Ont., Riverside — Albert Abar & Son, Island View Hotel, is having plans prepared for the constructon of a hotel including steam heating system, elevators, etc. on Riverside Dr. Estimated cost $650,000. Dangerfield & Winter, Huron & Erie Bldg., are architects.

Ont., Toronto—Canada Permanent Mortgage Corp., 14 Toronto St., will soon award contract for a 17 story office building including steam heating system, elevators, etc. at Bay and Adelaide Sts. Estimated cost $1,000,000. F. Hilton Wilkes, 96 Bloor St. W., is architect. Mathers & Haldenby, 96 Bloor St. W., associate architects and Sproot & Rolph, 1162 Bay St., consulting architects.

Ont., Toronto — Canadian Pacific Ry., Montreal, Que., awarded contract for the construction of a 17 story addition to hotel on Front St. here to Anglin-Norcross, Temple Bldg., Toronto. Estimated cost $1,000,000. Steam heating system, elevators, etc. will be installed.

Ont., Toronto — Toronto Medical Arts Bldg., Lumsden Bldg., awarded contract for the construction of a 9 story office building at Bloor and St. George Sts. to Anglin-Norcross Ltd., Temple Bldg. Estimated cost $500,000. Steam heating system, elevators, etc. will be installed.

Ont., Toronto — Wellington Building Corp., c/o Baldwin & Green, 26 Bloor St. W., is having plans prepared for an 11 story office building including steam heating system, elevators, etc. on Wellington St. Estimated cost $500,000.

Ont., Windsor—Norton Palmer Hotel Co., P. D. Norton, Managing Dir., plans the construction of a 12 story addition to hotel including steam heating system, etc. on Park St. Estimated cost $1,700,000.

Ont., Windsor — Prince Edward Hotel Co., M. Gilbert, Mgr., is having plans prepared for the construction of a 4 story addition to hotel on Ouellette Ave. Estimated cost $1,000,000. Pennington & Boyde, 1001 Security Bldg., are architects.

Ont., Windsor — Securities Development Co., Security Bldg., awarded contract for a 12 story office building on London St. W. to S. E. Dinsmore Co., Security Bldg. Estimated cost $750,000. Steam heating system, etc. will be installed.

Equipment Wanted

Compressor — Federal Foundry Supply Co., 2539 East 79th St., Cleveland, O., portable air compressor, gasoline engine driven, 100 cu.ft. capacity.

Engine—E. H. Harris, Birr, Ont., complete equipment including Diesel engine for chopping mills destroyed by fire. $25,000.

Engine and Generator — City of Marlow, Okla., plans the installation of a 600 hp. Diesel engine and generator unit in municipal electric light plant. Estimated cost $25,000.

Engine, Pumping Equipment, Switchboard, Etc. — City Commissioners, E. H. Mason, City Clk., Palmetto, Fla., will receive bids until Oct. 22nd for a 125 hp. Diesel oil engine direct connected to alternator pumping equipment for low-lift, service and fire pressure purposes, switchboard, etc. for proposed electric light and waterworks plant.

Engines—City of El Centro, Calif., plans to purchase three gas engines, automatic feeding device, etc. for proposed rock crushing plant for Mt. Signal Dist.

Pumping Equipment—Bd. of Water Commissioners, F. P. Book, Pres., Detroit, Mich., will receive bids until Oct. 24 for motor driven pumping equipment including pumping units, two 30 m.g.d. against 50 ft. head; three 60 m.g.d. against 50 ft. head; and three 60 m.g.d. against 60 ft. head for low lift plant at Springwells station.

Pumping Equipment — Common Council, N. D. Smith, Clk., Tipton, Ind., will receive bids until Oct. 5 for pumping equipment including one motor driven two stage air compressor, etc. for waterworks.

Pumps, Motors, Etc.—Village of Patchogue, N. Y., J. P. Losee, Clk., will receive bids until Oct. 16 for 3 in. duplex centrifugal pumps direct connected to one hp. electric motors for proposed sewer extensions at North Ocean Ave. and Oak St.

Industrial Projects

Calif., Los Angeles—CHEMICAL PLANT —Stauffer Chemical Co., Rives-Strong Bldg., had plans prepared for a chemical plant including caustic soda building, acid plant, etc. on Wilmington Ave. Estimated cost $750,000. Prvate plans.

Conn., Bristol—FACTORY—E. Ingraham Co., 392 North Main St., awarded contract for a 5 story, 50 x 162 ft. factory on North Main St. to Torrington Building Co., 182 Church St. Estimated cost $100,000.

Conn., Bristol—FACTORY—New Departure Mfg. Co., 269 North Main St., had plans prepared for a 1 story, 125 x 200 ft. factory at Terryville Ave. Estimated cost $75,000. Private plans.

Ill., Canton—GRINDING BUILDING, ETC.—The International Harvester Co., H. W. Bland, Plant Engr., awarded contract for addition to grinding building, also steel storage and steel shearing department to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $100,000.

Mass., New Bedford — RAYON FACTORY — New Bedford Rayon Co., Manoment Mills Plant, awarded contract for reconstruction and addition to 4 story rayon factory to Loche & Thomas, Olympia Bldg. Estimated cost $40,000.

Mich., Detroit — BODY PLANT ADDITION — Briggs Mfg. Co., 11631 Mack Ave., is having plans prepared for a 1 story, 80 x 100 ft. addition to plant for finishing automobile bodies on Mack Ave. A. Kahn, 1000 Marquette Bldg., is architect. Equipment for handling body and body parts will be required.

Mich., Detroit—BODY PLANT—Fisher Body Corp., General Motors Bldg., will receive bids about Oct. 1, for a 1 and 2 story, 100 x 800 and 40 x 100 ft. factory and office including steam power plant, etc. on French Rd. Estimated cost $500,000. Private plans.

Mich., Detroit—ENGINEERING BUILDING—Graham Paige Motor Corp., 8505 West Warren Ave., awarded contract for a 2 story, 60 x 300 ft. building for engineering building on Warren Ave. to M. J. Hoffman Construction Co., West Warren Ave. Estimated cost $150,000.

Mich., Detroit — COOLING SYSTEM FACTORY — Long Mfg. Co., 2768 East Grand Blvd., awarded contract for a 2 story factory for the manufacture of cooling systems to E. Chase, Penobscot Bldg. Estimated cost $50,000.

Mich., Detroit — GYPSUM PRODUCTS FACTORY — U. S. Gypsum Co., 1418 Penobscot Bldg., awarded contract for a 1 and 2 story gypsum products factory at Davison Ave. and River Rouge to Morton C. Tuttle, 31 St. James Ave., Boston, Mass.

Mich., Flint — AUTO MACHINE SHOP PLANT — Chevrolet Motor Co., General Motors Bldg., Detroit, awarded contract for a 1 story, 205 x 315 ft. auto machine shop plant in West Kearsley St. to H. G. Christman, Porter Apartments.

Mich., Highland Park (Detroit P. O.— Chrysler Motor Car Co., is having plans prepared for a 1 story, 45 x 400 ft. addition to automobile plant for engineering and experimental department on Oakland Ave. Estimated cost $55,000. Smith, Hichman & Grylls, 800 Marquette Bldg., Detroit, are architects.

Mich., Sturgis — PAPER PLANT — National Carbon Coated Paper Co., plans the construction of a 2 story, 80 x 200 ft. paper plant. Estimated cost $65,000. Billingham & Cobb, 211 Woodward Ave., Kalamazoo, are architects.

N. J., Camden—LEATHER FACTORY—C. K. Cook Co., 211 South Second St., awarded contract for a 3 story, 52 x 150 x 50 x 120 ft. addition to factory at Second and Mickle Sts. to H. John Homan, 18th and Cherry Sts., Philadelphia, Pa. Estimated cost $80,000.

N. J., Jersey City — PERFORATED METAL FACTORY—C. Mundt & Sons, 53 Fairmount Ave., is receiving bids for a 2 story, 35 x 132 ft. perforated metal factory on Johnson Ave. Estimated cost $40,000. J. T. Rowland, 30 Journal Sq., is architect.

N. C. Asheville — RAYON PLANT — American Enka Corp., A. F. L. Moritz, V. Pres. and Ch. Engr., 114 East 32nd St., New York, N. Y., is having plans prepared for the construction of a rayon plant in Hominy Creek Valley here. Estimated cost $10,000,000. Lockwood, Greene & Co., 1 Pershing Sq., New York, N. Y., are consulting engineers.